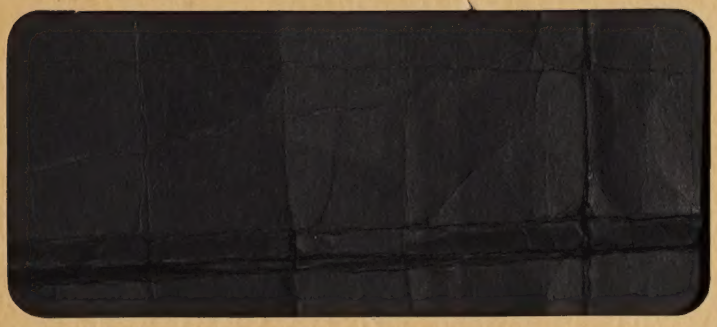
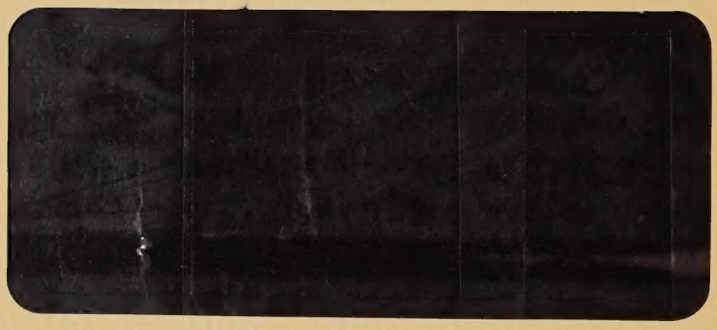


Texscan



OPERATING AND INSTRUCTION MANUAL

MODEL VS-90 B

SWEEP GENERATOR

TEXSCAN CORPORATION

2446 North Shadeland Avenue
Indianapolis, Indiana 46219

317-357-8781

CAUTION:

Units shipped from the factory are identified for operation from the proper input power source. Note the following:

(1) 230-volt rms, 50/60 Hz, single-phase power source.

A RED label marked "230V" is wrapped around the power cord within six inches (15 cm) of the polarized power plug. A RED label marked "230V" is also attached to the rear panel of the unit above the line-cord grommet.

(2) 115 volt rms, 50/60 Hz, single-phase power source.

A YELLOW label marked "115V" is wrapped around the power cord within six inches (15 cm) of the polarized power plug. A YELLOW label marked "115V" is also attached to the rear panel of the unit above the line-cord grommet.

Damage to any unit which is connected to a 230-volt power source, but which is wired internally for 115-volt operation constitutes "misuse", and is not covered by the TEXSCAN warranty. Consult the TEXSCAN instruction manual for the proper internal power-source connection if there is any question about the intended use. NOTE: The line fuse(s) must also be checked for the correct rating and type.

Digitized by the Internet Archive
in 2026

https://archive.org/details/manualsplus_11691

TABLE OF CONTENTS

SECTION	TITLE	PAGE
1	SPECIFICATIONS	1-1
1.1	FREQUENCY RANGE	1-1
1.2	FREQUENCY DIAL ACCURACY	1-1
1.3	SWEEP WIDTH	1-1
1.4	RF OUTPUT	1-1
1.5	FLATNESS	1-1
1.6	HARMONIC & SPURIOUS DISTORTION	1-1
1.7	LINEARITY	1-1
1-8	RESIDUAL FM	1-1
1.9	DRIFT	1-1
1.10	MARKERS	1-1
1.11	SWEEP RATE	1-2
1.12	ATTENUATION	1-2
1.13	MONITOR	1-2
1.14	RF OUTPUT CONNECTORS	1-2
1.15	HORIZONTAL DRIVE	1-2
1.16	SIZE	1-2
1.17	CONSTRUCTION	1-2
1.18	WEIGHT	1-2
1.19	POWER CONSUMPTION	1-2
1.20	1-kHz MODULATION	1-2
1.21	OPTIONS	1-3
1.22	ACCESSORIES	1-3

SECTION	TITLE	PAGE
2	TECHNICAL DESCRIPTION	2-1
2.1	GENERAL	2-1
2.2	DETAILED DESCRIPTION	2-3
3.	OPERATING INSTRUCTIONS	3-1
3.1	INTRODUCTION	3-1
3.2	DESCRIPTION OF FRONT PANEL CONTROLS AND CONNECTORS	3-1
3.3	OPERATING INSTRUCTIONS	3-5
3.4	EQUIPMENT REQUIRED	3-6
3.5	PRELIMINARY SETUP	3-6
4	APPLICATIONS	4-1
4.1	INTRODUCTION	4-1
4.2	FREQUENCY RESPONSE AND BANDWIDTH OF FILTERS	4-1
4.3	GAIN OF AMPLIFIERS	4-2
4.4	ANTENNA MEASUREMENTS	4-4
4.5	STRUCTURAL RETURN LOSS OF CABLE	4-8
4.6	INSERTION LOSS	4-10
4.7	DETERMINATION OF AMPLITUDE AND PHASE MEASUREMENT	4-10
5	ALIGNMENT AND ADJUSTMENT PROCEDURES	5-1
5.1	INTRODUCTION	5-1
5.2	POWER SUPPLY	5-1
5.3	RATE CIRCUITRY	5-2
5.4	LINEARITY CIRCUITS	5-4
5.5	1 kHz MODULATOR	5-6
5.6	MARKER AMPLIFIER	
5.7	RF LEVEL ADJUSTMENT	5-7

SECTION	TITLE	PAGE
6	DOCUMENTATION	6-1
6.1	PARTS LIST	6-1
6.2	SCHEMATIC DIAGRAMS	
	Figure 6.1: BASIC SWEEP GENERATOR	
	Figure 6.2: POWER SUPPLY	
	Figure 6.3: MARKER CIRCUITS	
	Figure 6.4: MAIN PCB	
	WARRANTY INFORMATION	

ILLUSTRATIONS

NUMBER	TITLE	PAGE
2-1	VS-90B BLOCK DIAGRAM	2-2
3-1	VS-90B FRONT PANEL VIEW	3-3
3-2	115/230V AC WIRING DIAGRAM	3-4
3-4	SETUP USING REFLECTION COEFFICIENT BRIDGE	3-7
3-5	HIGH BAND TEST DISPLAY	3-9
4-1	TEST SETUP	4-3
4-2	PARAMETERS RELATED TO VSWR	4-5
4-3	NOMOGRAPH OF VSWR REDUCTION FOR GIVEN ATTENUATION	4-6
4-4	POWER VALUES vs VSWR	4-7
4.5	TABLE OF STRUCTURAL RETURN LOSS & INSERTION LOSS VS. VSWR	4-9
4.6	SETUP FOR DETERMINING AMPLITUDE AND PHASE CHARACTERISTICS	4-11

SECTION 1

VS-90B SPECIFICATIONS

1.1	FREQUENCY RANGE	5 MHz to 2350 MHz in three overlapping bands. Low band: 5 to 800 MHz. Middle band: 750 to 1300 MHz High Band: 1250 to 2350 MHz
1.2	FREQUENCY DIAL ACCURACY	Within 2% of the output frequency or +8 MHz, whichever is greater.
1.3	SWEEP WIDTH	Low band: the sweep width is continuously variable from 100 kHz to 800 MHz. Middle band: continuously variable to 550 MHz. High band: continuously variable to 1100 MHz. The unit is also provided with a CW output mode for signal generator applications.
1.4	RF OUTPUT	The RF output is at least 0.7 volt rms into a 50 oor 75 ohm load.
1.5	FLATNESS	The flatness if $\pm$0.5 dB at maximum sweep width (tested with a CD-51 detector).
1.6	SPURIOUS & HARMONIC DISTORTION	Low band: 10-800 MHz -25 dB typically 30 dB Mid band: 750-1300 MHz -35 dB typically 40 dB Hi band: 1250-2350 MHz -35 dB typically 40 dB
1.7	LINEARITY	The linearity of output frequency versus time is within 3% of maximum sweep width as referenced to a straight line function.
1.8	RESIDUAL FM	The residual FM is better than 15 kHz in the CW mode.
1.9	DRIFT	300 kHz/5 Min. after 30 Min. warm up in desired band.
1.10	MARKERS	The unit has a birdie-bypass marker system with provision for up to four single frequency or harmonic frequency markers. An external marker input is provided which can be used with a CW source to produce a variable marker. A 100 mV signal produces a marker greater than 1 volt peak-to-peak.

1.11	SWEEP RATE	Five sweep rate modes are provided: (1) variable from 5 to 60 Hz, (2) variable from 0.05 to 5 Hz, (3) 50/60 Hz line rate, (4) manual sweep, and (5) external. The external sweep drive has an input impedance of approximately 100K ohms. A 12 volt peak-to-peak waveform will produce maximum dispersion. The unit will respond to input frequencies as high as 30 kHz.
1.12	ATTENUATION	The unit has a 0 to 3 dB vernier control of RF output, and turret attenuators which provide 0 to 70 dB attenuation in 1 dB steps.
1.13	MONITOR	Both an internal leveling system and facility to use an external monitor are provided. If an external monitor is used, it must provide a DC signal of at least -0.1 volt for proper leveling.
1.14	RF OUTPUT CONNECTORS	Type N.
1.15	HORIZONTAL DRIVE	A triangular waveform of at least 10 volt peak-to-peak is provided for oscilloscope horizontal drive. The horizontal output impedance is less than 10K ohms.
1.16	SIZE	6 7/8" X 17" X 16".
1.17	CONSTRUCTION	Aluminum with G-10 printed circuit boards.
1.18	WEIGHT	Approximately 28 lbs., shipping weight 30 lbs.
1.19	POWER CONSUMPTION	Approximately 30 watts, 50/60 Hz, 115/230 volt power.
1.20	1-kHz MODULATION	The unit is provided with a switchable 1 kHz square wave, 100% amplitude modulation capability.

1.21 OPTIONS

External Modulation	The unit can be supplied with uncalibrated amplitude modulation capability (Option S).
Pin Lift Feature	A rear panel connector can be supplied which provides a short circuit during sweep time, and an open circuit during retrace to use with the pen lift feature of a graphic recorder. (Option P).
Rack Mount Kit	The VS-90B can be converted for rack mounting with this kit (Option RM).
CM Markers	A single assembly of fixed markers with up to three of either 1, 10, 50, or 100 MHz harmonic markers controlled from the front panel.

1.22 ACCESSORIES

Log Detector	Texscan Model IN-40A.
RF Detector	Texscan Model CD-51.
External Monitor	Texscan Model EM-61.
Cable Set	Texscan Cable 501.

SECTION 2

TECHNICAL DESCRIPTION

2.1 GENERAL

A block diagram of the VS-90B Sweep Generator is shown in Figure 2.1. Schematic diagrams are provided in Section 6. The VS-90B is a solid-state instrument that provides 86 dB of continuously adjustable swept RF output (up to 0.7 volts rms into 50 ohms) in three overlapping frequency bands: 5 to 800 MHz, 750 to 1300 MHz, and 1250 to 2350 MHz. The band switch actuates the RF sweep oscillator and other circuits associated with a given band. The high-band oscillator sweeps the 1250 to 2350 MHz band. The middle-band oscillator sweeps the 750 to 1300 MHz band. The high-band oscillator is heterodyned with the fixed 1500 MHz low-band oscillator, and the lower sideband, which sweeps the 5 to 800 MHz band, is amplified by a video amplifier to the required RF level. Each RF oscillator sweeps the full band width, or a selected fraction of full band width. In CW mode, when the RF oscillator is not sweeping, the VS-90B can be used for signal generator applications.

An internal automatic level control (ALC) loop in each band provides RF signal leveling at the monitor point, and establishes the 50 ohm source impedance of the generator. A detected sample of the RF signal voltage obtained at the monitor point is compared to a DC reference voltage in the leveler. The leveler amplifies the difference between the two voltages, and supplies control bias to the diode attenuator selected by the band switch. The diode attenuator in each band atuomatically regulates the RF signal level. By setting the leveler DC reference voltage, the RF VERNIER provides 6 dB of continuously adjustable RF output. Two rotary steps attenuators provide 80 dB of RF output attenuation in 1 dB and 10 dB steps.

A marker bypass system provides accurate frequency identification in the RF sweep display. The VS-90B will accept optional fixed CM markers, and up to four optional HM (harmonic) or SM (single) markers. An external CW generator can also be used as a marker. When markers are used, an RF sweep sample is obtained at the monitor point. External and internal markers are heterodyned with the RF sweep sample. The resulting sideband around the zero beat produce beatnotes or birdies that are amplified and passed through a 50 kHz bandpass filter and amplifier. The filtered and amplified birdie markers are added to the detected RF sweep input signal from the VIDEO IN connector for combined display at the SCOPE VERT connector.

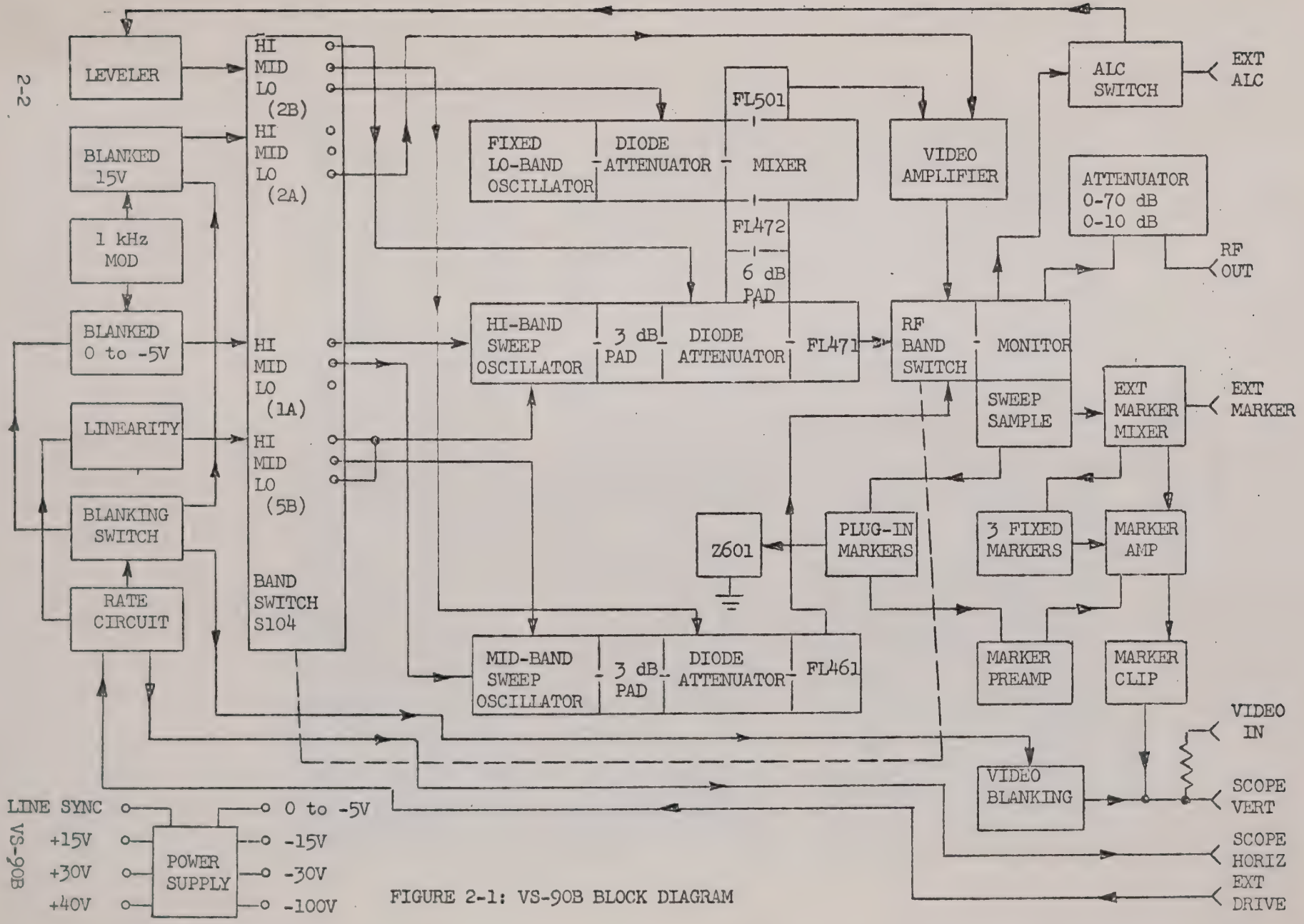


FIGURE 2-1: VS-90B BLOCK DIAGRAM

The rate circuit generates synchronized square and triangular voltage waves. The square waves actuate blanking circuits that project a virtual zero baseline in the detected RF sweep display during the retrace interval. Triangular waves drive the horizontal deflection circuits in the display unit, and the linearity circuit in the VS-90B. By amplifying and shaping input triangular waves, the linearity circuit supplies sweep drive voltage waves to varactor diodes in the RF oscillators that result in linear frequency display characteristics. The rate circuit permits flexible control of sweep rate, and the linearity circuit permits flexible control of sweep width and center frequency.

Alignment of the following circuits is provided in Section 5.

2.2 DETAILED DESCRIPTION

2.2.1 Rate Circuit (Figure 6.1)

The rate circuit consists of a level detector and integrator combination that uses operational amplifier IC101. Square waves at pin 1 of IC101 are coupled to blanking switch S102. Constant-amplitude triangular waves at pin 7 of IC101 are coupled to the SCOPE HORIZ connector J102, and to the linearity circuit. Settings of SWEEP RATE switch S103 and vernier R126B determine sweep rate frequency in the two variable modes. A line-sync signal controls sweep rate in LINE mode. In MANUAL mode an adjustable DC voltage controlled by vernier R126A replaces the triangular waves. The DC voltage limits are equal to the triangular wave peaks. The voltage peaks determine horizontal display limits. An EXT DRIVE connector permits external control of the rate circuit in EXT position of S103.

2.2.2 Linearity Circuit (Figure 6-1)

The linearity circuit amplifies and shapes triangular waves from the rate generator, and supplies sweep-drive voltage to the high and middle-band oscillators. The sweep-drive voltage compensates for exponential voltage-versus-capacitance characteristics of the varactor diodes, and enables the two RF oscillators to provide linear sweep frequency display characteristics. The linearity circuit consists of sweep width and center frequency controls, and a summing amplifier with feedback. The amplifier consists of IC201, Q201, Q202, Q203, and a feedback path containing a voltage-shaping network for each of the two RF sweep oscillators. Each voltage-shaping network uses factory selected resistors to obtain the required sweep-drive voltage waveshapes. Sweep width controls determine input DC level. The sum of the inputs, including the shaped feedback voltage, are coupled to pin 2 of IC201. The output of the summing amplifier at the emitter of Q203 is coupled to the band switch (section 5B of S104) and subsequently to varactor diodes in the RF oscillators.

2.2.3 Blanking Circuits (Figures 6.1 and 6.2)

Internal slide-switch S102 selects either video (normal) or RF blanking that project a virtual zero baseline in the detected RF sweep display during retrace. Blanking is achieved by means of electronic switching circuits that are actuated by the square waves from the rate circuit. In video blanking Q306 shorts SCOPE VERT connector J305 to ground during retrace. In RF blanking, the RF sweep output is shut off during retrace. In RF blanking the 5 to 800 MHz band, IC102 and Q103 cause the +15 volt supply to the video amplifier to shut off during retrace. Q15 shuts off the 0 to -5 volt emitter bias supply to the middle and high band oscillators during retrace.

2.2.4 Band Switch (Figure 6.1)

Band switch S104 consists of sections 1A through 8A, and 1B through 6B. Section 8A is a coaxial RF switch with three inputs, and an output that is coupled to the sweep generator source resistor R485. Other switch sections consist of a 7-section two-pole three-position wafer-switch assembly. Section 7A controls the dial lights in the slide-rule dial that indicates the operating frequency band. The remaining sections of the band switch actuate only those circuits required to operate a given band including alignment controls.

2.2.5 High-Band Oscillator

The high band oscillator consists of two identical sections of a varactor-tuned, balanced-harmonic transistor oscillator. In the 1250 to 2350 MHz band this oscillator sweeps from 1250 MHz minimum to 2350 MHz maximum. In the 5 to 800 MHz band the high-band oscillator, sweeping from 1505 MHz minimum to 2300 MHz maximum, is heterodyned with the fixed 1500 MHz low-band oscillator. Center frequency and sweep width controls, including the alignment controls selected by the band switch, provide electronic tuning of the high band oscillator by controlling sweep-drive voltage to the varactor diodes. The varactor diodes are voltage tuned capacitors that determine oscillator frequency. In the 1250 to 2350 MHz band, the RF output of the high-band oscillator is subsequently attenuated, leveled, filtered and monitored to provide required output characteristics. The high-band oscillator is Texscan part number A204-821.

2.2.6 Middle-Band Oscillator

The middle-band oscillator consists of a varactor-tuned transistor oscillator that sweeps the 750 to 1300 MHz band. The RF output of the middle-band oscillator is loop-coupled to a common-emitter transistor amplifier stage. The amplifier is coupled to the diode attenuator, and subsequently to lowpass filter FL601. The middle-band oscillator, amplifier, diode attenuator, and lowpass filter are packaged as a single module (Texscan part number A204-823). The output of FL601 is coupled to the coaxial bandswitch and monitor assembly.

2.2.7 Low-Band Oscillator

The 1500 MHz fixed low-band oscillator is heterodyned with the high-band oscillator, and the lower sideband output sweeps the 5 to 800 MHz band. The low-band oscillator module (Texscan part number A204-768) consists of a 1500 MHz tuned-line transistor oscillator, a diode attenuator, a double-balanced diode mixer, and a lowpass filter FL501. FL501 is coupled to the video amplfier.

2.2.8 Video Amplifier

The video amplifier (Texscan part number A204-826) consists of seven cascaded common-emitter transistor amplifier stages. The first five stages are supplied with +15 volts. During RF blanking or 1 kHz modulation, the +15 volt supply is electronically switched by Q103. Each stage is compensated to provide the required broad-band response. The video amplifier output is coupled to the coaxial bandswitch.

2.2.9 Monitor (Figure 6.1)

The monitor point (the junction of the source resistor R485 and sampling resistor R486) is located in the coaxial RF bandswitch assembly. The RF sweep level is sampled at the monitor point by R485. Diode CR481 converts the RF sweep signal to a negative voltage that is coupled to the leveler. Automatic level control action establishes the monitor point as a zero-impedance, constant-voltage point, and R485 becomes a constant 50 ohm source impedance of the sweep generator.

2.2.10 Leveler (Figure 6.1)

The leveler is a DC amplifier in the ALC loop that maintains the specified flatness of the RF output sweep level. The ALC loop consists of the monitor, the ALC switch, the leveler, the operating diode attenuator, and the forward RF signal path to the monitor. The leveler consists of operational amplifier IC103 and emitter-follower Q104. The DC reference voltage input to pin 2 of IC103 is obtained from RF LEVEL control R154, MIN control R155, and MAX control R156. When the VS-90B is leveled externally the MAX and MIN controls are reset. The leveler output is proportional to the difference between the DC reference voltage at pin 2 and the DC monitor sample voltage at pin 3 of IC103. The leveler drives the diode attenuator selected by the bandswitch S104-2B.

2.2.11 Diode Attenuators

A diode attenuator is required for each frequency band. The high and middle-band diode attenuators use three diodes each in a pi-configuration. The low-band diode attenuator uses three diodes in a tee-configuration. Factory settings of R600, R601, and RR602 determine the fixed bias levels in the attenuators. The combination of fixed bias and of control bias from the leveler determines attenuator characteristics, and the resultant RF sweep signal level for each diode attenuator. The high-band diode attenuator is bypassed in the 5 to 800 MHz band, and the low-band fixed oscillator level is controlled.

2.2.12 Power Supply (Figure 6.2)

Transformer T1 has a dual primary which can be connected for 115 volt or 230 volt, single phase, 50 to 60 Hz operation. The connection diagram in Figure 3-2 shows P-C board jumpers for each input voltage.

The 6 volt secondary supplies the line-sync signal used in LINE mode of the rate generator. Three sets of dial lights also use the 6 volt winding.

The following DC voltages are provided: +40V, +30V, +15V, 0 to -5V, -15V, -30V, and -100V.

The +30 volt regulator consists of pass transistor Q1 and operational amplifier IC1. Open base transistor Q3 is used as a temperature-compensated voltage reference. Q2 and R2 provide load-current limiting of the regulator.

The +15 volt regulator consists of pass-transistor Q4 and operational amplifier IC2. The voltage reference is obtained at the junction of R11 and R12. Q5 and R14 provide load-current limiting of the +15 volt regulator.

The -30 volt and -15 volt regulators are similar in operation to the +30 volt and +15 volt regulators.

The 0 to -5 volt regulator consists of pass transistor Q13 and one-half of dual op-amp IC4. Q12 and R37 provide load-current limiting. Emitter bias for the RF sweep oscillators is set by R34. Q15 acting as an electronic switch turns off the bias supply during blanking and 1 kHz modulation.

The -100 volt regulator consists of emitter-follower regulator Q14, and reference voltage diodes VR3 and VR6.

2.2.13 Plug-in Markers (Figure 6.3)

The marker bypass system is described in paragraph 2.2. Provision is made for one-through-four plug-in harmonic (HM) or single-frequency (SM) markers in J301 through J304. An RF sample obtained from the monitor point through R483 at J485 is heterodyned with crystal-controlled markers using mixer diodes located in the plug-in markers. The final plug-in marker in a series is terminated by AT481. The resulting side-bands around the zero beat are amplified by Q301 or Q302 and Q303, filtered by the shaping network, amplified by Q305, and added to the detected RF sweep signal at VIDEO IN connector J306 for combined display at SCOPE VERT connector J305. Marker amplitudes are displayed as a group by MARKER INT SIZE control R327, or individually by internal controls such as R305. A marker clip feature using CR301 and CR302 blanks the negative-half of the marker display when actuated.

2.2.14 Fixed CM Markers (Figure 6.3)

Provision is made for an internal fixed CM marker module that displays up to three fixed harmonic markers. The RF sweep sample is obtained through R481, R356, and J353. CM markers are amplified by Q304 for subsequent filtering and display.

2.2.15 External Marker (Figure 6-3)

An external CW signal coupled to J351 is heterodyned with the RF sweep sample at CR351. The resulting sidebands are amplified by Q304 for subsequent filtering and display. The external marker amplitude is adjusted by R331, the MARKER EXT SIZE control.

2.2.16 1.0-kHz Modulation Circuit (Figure 6.1)

When the 1-kHz MOD switch S106 is actuated, the 1.0-kHz square-wave modulator operates. The modulator provides 100-percent amplitude modulation of the RF output by a 1.0 kHz square wave. The modulator consists of an astable multivibrator circuit (Q701 and Q702). Operation of the modulator is similar to RF blanking described in 2.2.3. The video amplifier is modulated in the 5 to 800 MHz band, and the middle-band and high-band sweep oscillators are modulated in the other bands.

SECTION 3

OPERATING INSTRUCTIONS

3.1 INTRODUCTION

The VS-90B can be used as an RF sweep generator or as an RF signal (CW) generator. Most of the operating features can be understood by a description of front-panel controls and connectors. See Figure 3.1. The VS-90B can be supplied from a 115 volt or 230 volt, single-phase, 50/60 Hz power source.

NOTE: Before connecting the VS-90B to a power source, make sure the VS-90B is wired for the correct line voltage. See Figure 3.2.

3.2 DESCRIPTION OF FRONT PANEL CONTROLS AND CONNECTORS

3.2.1 POWER Switch

This pushbutton switch applies power to the VS-90B. The slide-rule CENTER FREQUENCY dial is illuminated when the POWER switch is in ON position.

3.2.2 CENTER FREQUENCY Dial

The position of the pointer on the slide-rule dial indicates the frequency of oscillation in CW mode, and the center frequency in sweep modes. Pilot lights illuminate the operating frequency range determined by the BAND switch setting.

3.2.3 CENTER FREQUENCY Control

The position of this control determines the oscillator frequency indicated by the pointer on the slide-rule CENTER FREQUENCY dial.

3.2.4 SWEEP RATE Controls

This is a dual concentric control. The outer knob selects the mode of sweep rate operation. In LINE position, the sweep rate is locked to the power-line frequency. In 5 to 60 Hz and 0.05 to 5 Hz positions, the sweep rate is determined by the inner knob position in the range indicated by the outer knob. In MAN (manual) position, the RF oscillator frequency may be controlled at any point within the sweep interval established by settings of the CENTER FREQUENCY control and the SWEEP WIDTH controls, by adjustment of the inner knob of the SWEEP RATE controls. In EXT position the sweep may be driven by an external signal. In both MANUAL and EXT positions blanking of the retrace is disabled.

3.2.5 SWEEP WIDTH Controls

This is a dual concentric control. The outer knob selects either WIDE or NARROW sweep width, or provides the CW mode of oscillator operation. The inner knob varies sweep width within the range selected by the outer knob.

3.2.6 RF LEVEL and ALC Controls

This is a dual concentric control. The outer knob selects either internal or external monitor signals as the RF level control signal. If no external monitor is used, this switch may be used to open the internal level control loop. For normal internal leveling set the outer control to INT position. The inner knob provides a continuously variable adjustment of RF output over a 6 dB range.

3.2.7 BAND (MHz) Switch

This switch selects either the high, middle, or low band of frequencies indicated by the lighted slide-rule CENTER FREQUENCY dial.

3.2.8 ATTENUATION Controls

Two rotary attenuator controls provide attenuation of the RF output from 0 to 70 dB in 10-dB steps, and 0 to 10 dB in 1-dB steps for a total of 0 to 80 dB.

3.2.9 MARKERS Switches and MKR CLIP Switch

The pushbutton switches are depressed to select the internal marker generators, either singly or in combination. Beginning from left-to-right the first four switches actuate optional plug-in markers (HM or SM). Pushbuttons five through seven are used for optional CM-1 markers. The MKR CLIP pushbutton actuates the function that blanks the negative half of all displayed markers.

3.2.10 MARKER EXT/CM-1 SIZE

This control permits amplitude adjustment of the external marker (optional) and the CM-1 markers (optional).

3.2.11 MARKER INT SIZE and MARKER SHAPER

This is a dual concentric control. The inner knob varies the size (amplitude) of the birdie markers. The outer diameter knob varies the bandpass of the marker amplifier, and controls the width of the birdie marker.

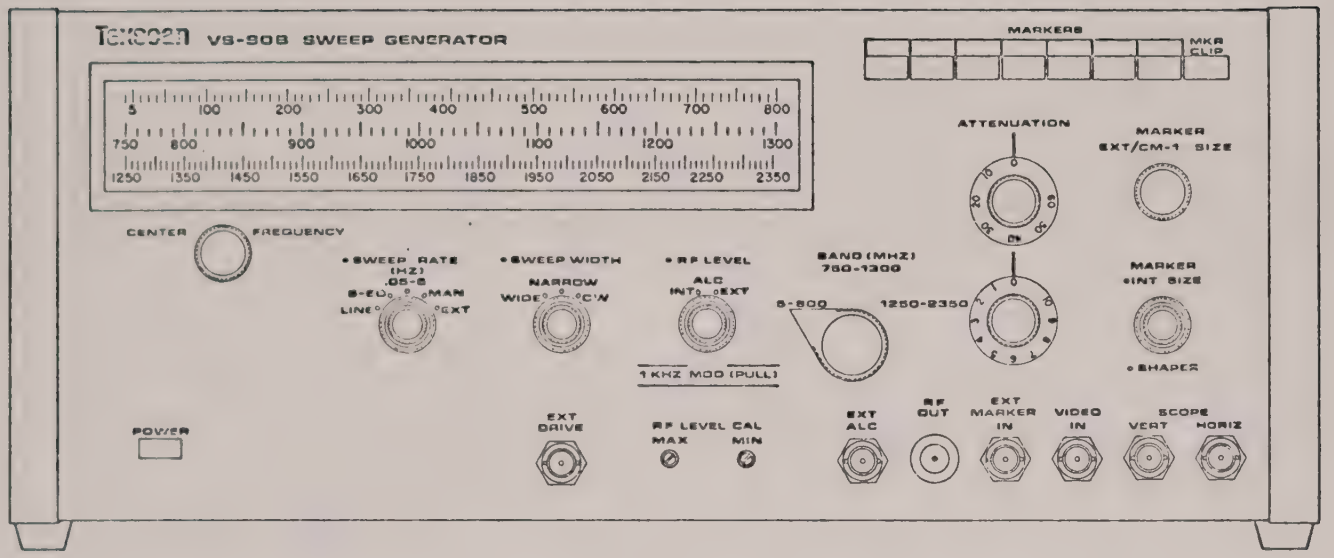
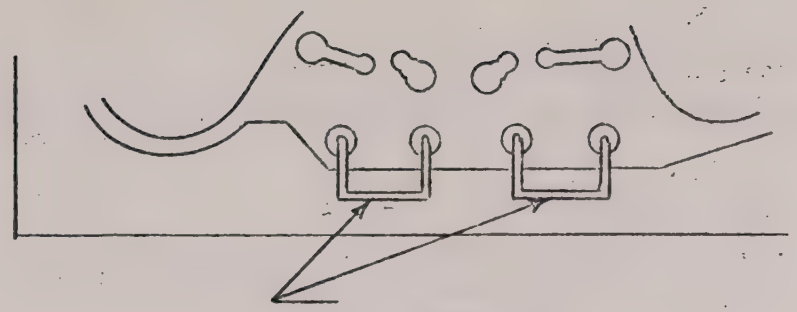
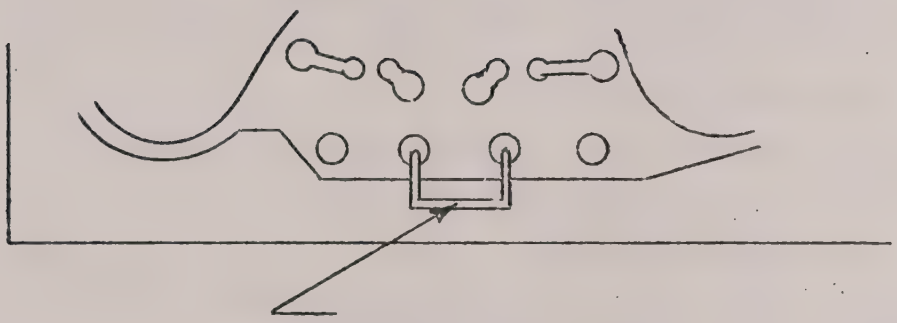

TEKTRONIX VS-90B SWEEP GENERATOR
MARKERS
MKR CLIP
5 100 200 300 400 500 600 700 800
750 800 900 1000 1100 1200 1300
1250 1350 1450 1550 1650 1750 1850 1950 2050 2150 2250 2350
ATTENUATION
MARKER EXT/CM-1 SIZE
CENTER FREQUENCY
• SWEEP RATE (HZ) .05-5 SEC MAN LINE EXT
• SWEEP WIDTH NARROW WIDE CW
• RF LEVEL ALC INT EXT
BAND (MHZ) 780-1300 5-800 1250-2350
MARKER •INT SIZE
• SHAPER
1 KHZ MOD (PULL)
POWER
EXT DRIVE
RF LEVEL CAL MAX MIN
EXT ALC
RF OUT
EXT MARKER IN
VIDEO IN
SCOPE VERT HORIZ

FIGURE 3-1: VS-90B FRONT PANEL VIEW



115V AC JUMPERS (2)



230V AC JUMPER

TOP VIEW OF POWER SUPPLY PCB

FIGURE 3-2: 115/230V AC WIRING DIAGRAM

3.2.12 SCOPE HORIZ Connector

The oscilloscope horizontal deflection signal is available at this connector.

3.2.13 SCOPE VERT Connector

The detected RF signal with markers and video blanking is available at this connector as the vertical oscilloscope input.

3.2.14 VIDEO IN Connector

The detected RF signal from the device under test is coupled to this connector for addition of the marker and video blanking signal.

3.2.15 EXT MARKER IN Connector

This connector allows an external RF signal source to be applied to the marker system for addition to the detected video output.

3.2.16 RF OUT Connector

The sweep generator RF output (swept or CW) is available at this connector.

3.2.17 EXT ALC Connector

The monitor signal from an external monitor (Texscan EM-61) if used, is connected here to provide external leveling.

3.2.18 1 kHz MOD (PULL) Switch

When the RF LEVEL knob is pulled out, the RF output signal is modulated by a 1 kHz square wave.

3.2.19 EXT DRIVE Connector

When the SWEEP RATE switch is set to EXT position, an external sweep drive (12 volt peak-to-peak) may be coupled to this connector.

3.3 OPERATING INSTRUCTION

Prior to applying power to the VS-90B, make the following checks:

3.3.1

Check the color of the line cord tag. Yellow indicates that the unit is wired for 115V AC. Red indicates that the unit is wired for 230V AC operation.

3.3.2

If the unit is not wired for the AC line voltage available, refer to Figure 3.2 for the AC wiring diagram.

3.3.3

Check the fuse (rear panel) and determine that it is the correct value for the line voltage to be used.

NOTE: Severe damage may result from operating the VS-90B from AC line voltages other than that for which it is wired.

3.4 EQUIPMENT REQUIRED

Sweep Generator	VS-90B
Oscilloscope	Texscan DU-88 or equivalent
Variable Marker Generator	Texscan VS-80 or equivalent
Detector	Texscan CD-51 or equivalent
Reflection Coefficient Bridge	Texscan RCB-4 or equivalent

3.5 PRELIMINARY SETUP (See Figure 3.3)

Refer to Figure 3-1 for location of front panel controls.

3.5.1

Connect	To
POWER	ON
BAND	1250 to 2350 MHz
CENTER FREQUENCY	1800 MHz
SWEEP WIDTH	WIDE/max clockwise
SWEEP RATE	LINE
ALC	INT
RF LEVEL	Max clockwise
1 kHz MOD	OFF (Push in)
ATTENUATION	0 dB/0 dB
MARKER EXT/CM-1 SIZE	Mid-range
MARKER SHAPER	Mid-range
MARKER INT SIZE	Mid-range
MARKERS	50- MHz Markers ON

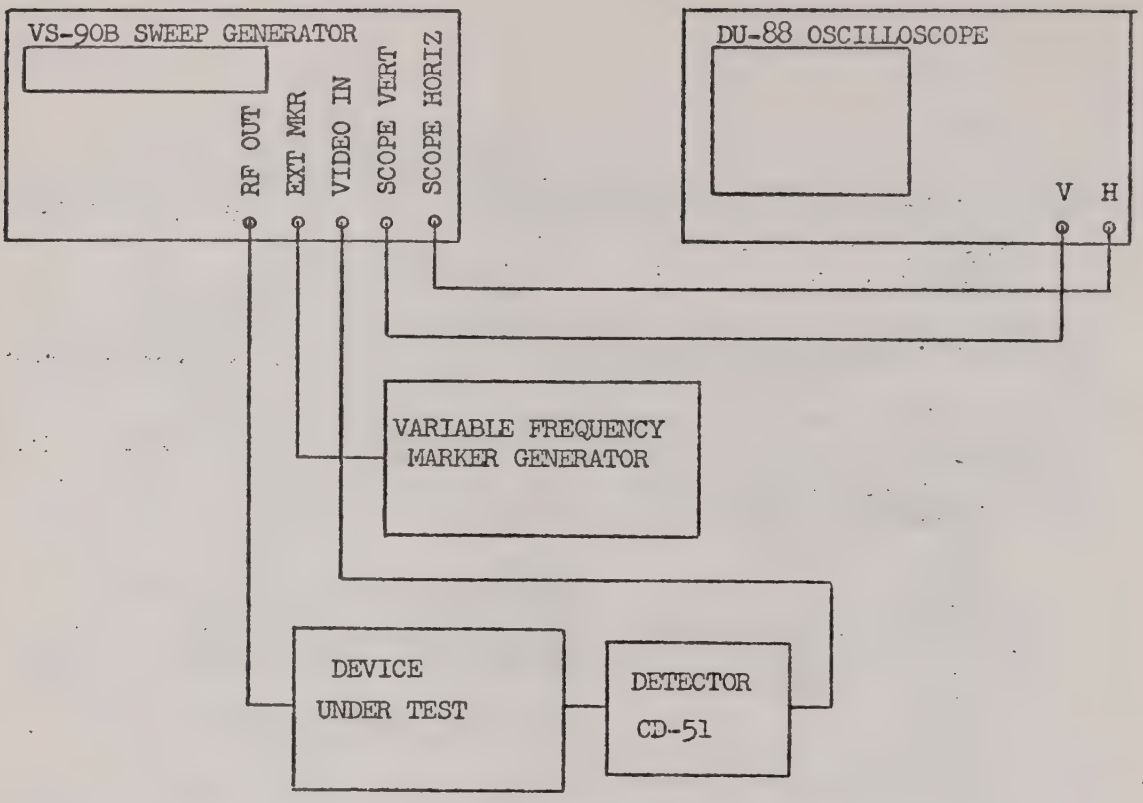


FIGURE 3.3: TEST SETUP

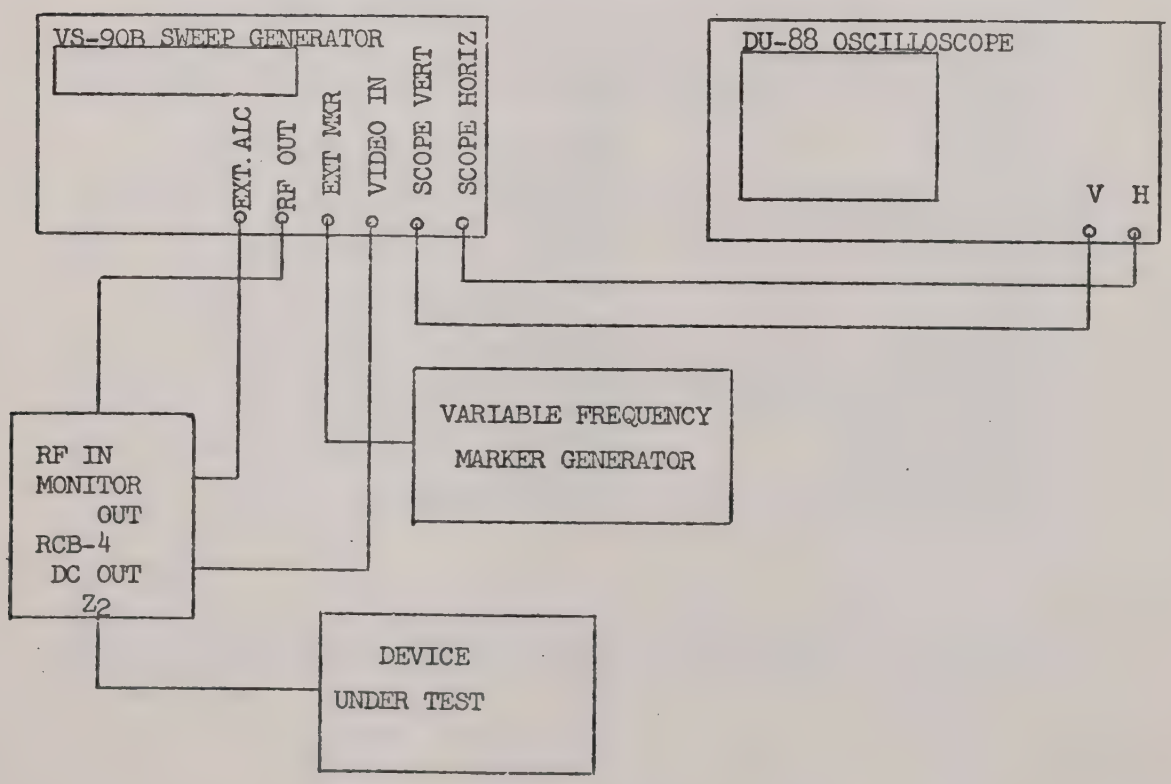


FIGURE 3.4: SETUP USING REFLECTION COEFFICIENT BRIDGE

3.5.2

Set	To
Variable Marker Generator	1800 MHz
Oscilloscope	
Horiz sync	External
Horiz coupling	DC
Horiz gain, Horiz position	
Vert gain, Vert position	As required to present sweep pattern

3.5.3

With device under test removed, the oscilloscope display pattern should be approximately as shown in Figure 3.5.

3.6 SETUP FOR EXTERNAL LEVELING (See Figure 3.4)

Perform 3.5.1 above except as follows:

3.5.1

Set	To
ALC	EXT

3.6.2

Connect	To (RCB-4)
RF OUTPUT	RF IN
EXT ALC	Monitor OUT
VIDEO IN	DC OUT
Device under Test	Z2
Z1 (RCB-4)	Standard Termination

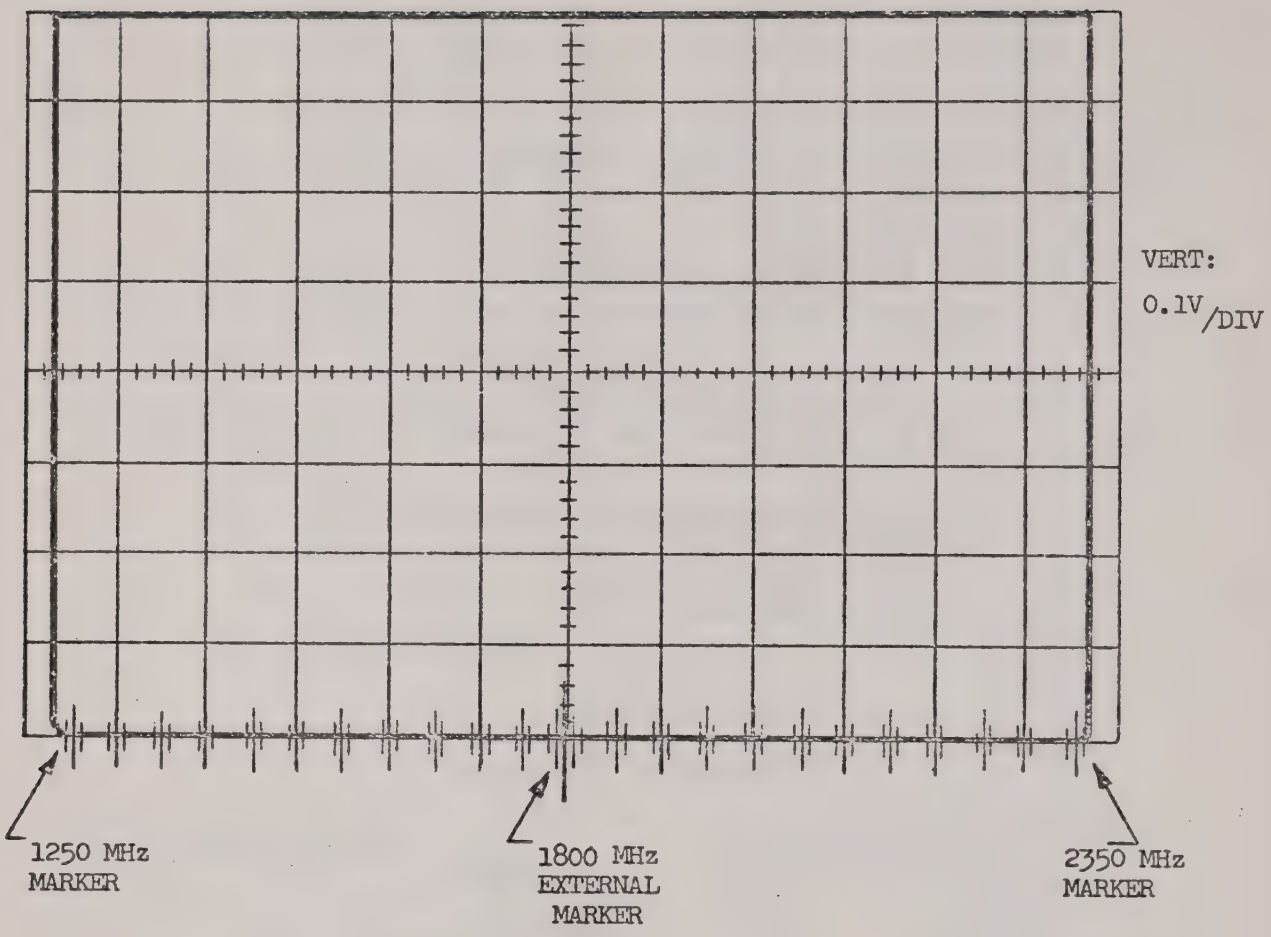


FIGURE 3.5: HIGH BAND TEST DISPLAY

SECTION 4

APPLICATION

4.1 INTRODUCTION

Several applications of Texscan VS Sweep Generators will be presented in this section. The basic information provided by the measurements are bandwidth, frequency response (gain and/or loss), and VSWR. Proper interpretation of these parameters will permit detailed analysis of amplifiers, filters, cables, antennas and other RF devices.

Extra equipment may be required for portions of the following measurements. The extra equipment is listed for each test.

The following test setups and results will be discussed:

Frequency Response and Bandwidth

Filters	Cavities
Amplifiers	Tuned Circuits
Antennas	

Loss Measurements of

Cables
Filters

4.2 FREQUENCY RESPONSE AND BANDWIDTH OF FILTERS

4.2.1

Perform preliminary setup in Figure 3.3.

NOTE: Use slow sweep rates with high "Q" filters. Excessive sweep rate may cause distortion of the response or "ringing" of the filter under test.

4.2.2

Set an acceptable RF input level.

4.2.3

Insert frequency markers as desired.

4.2.4

Adjust the response of the filter as desired.

NOTE: To determine the filter response in dB, proceed as follows: Leave the attenuation set at the level required for undistorted filter response as in 4.2.2. Remove the device under test.

Connect the CD-51 detector to the RF output. Use a grease pencil or other suitable device and mark the position of the swept trace on the oscilloscope graticule. This position corresponds to 0 dB. Increase the attenuation in increments suitable to the job requirements and mark the position of the swept trace at each increment.

Reset the attenuation to the level in (2) above. Reconnect the device under test.

4.2.5

Read the loss characteristics directly from the oscilloscope trace.

4.3 GAIN OF AMPLIFIERS

4.3.1

Extra equipment required:

Isolating network
Electronic Switch
Variable Attenuator

4.3.2

Connect the equipment per Figure 4.1.

4.3.3

Set RF output to a level which will not overload the amplifier.

NOTE: If the amplifier to be adjusted has automatic gain control (AGC) circuitry, replace the AGC bias with a fixed bias supply.

4.3.4

Figure 4.1 depicts a method for simultaneous display of input and output levels.

4.3.5

Apply frequency markers as required.

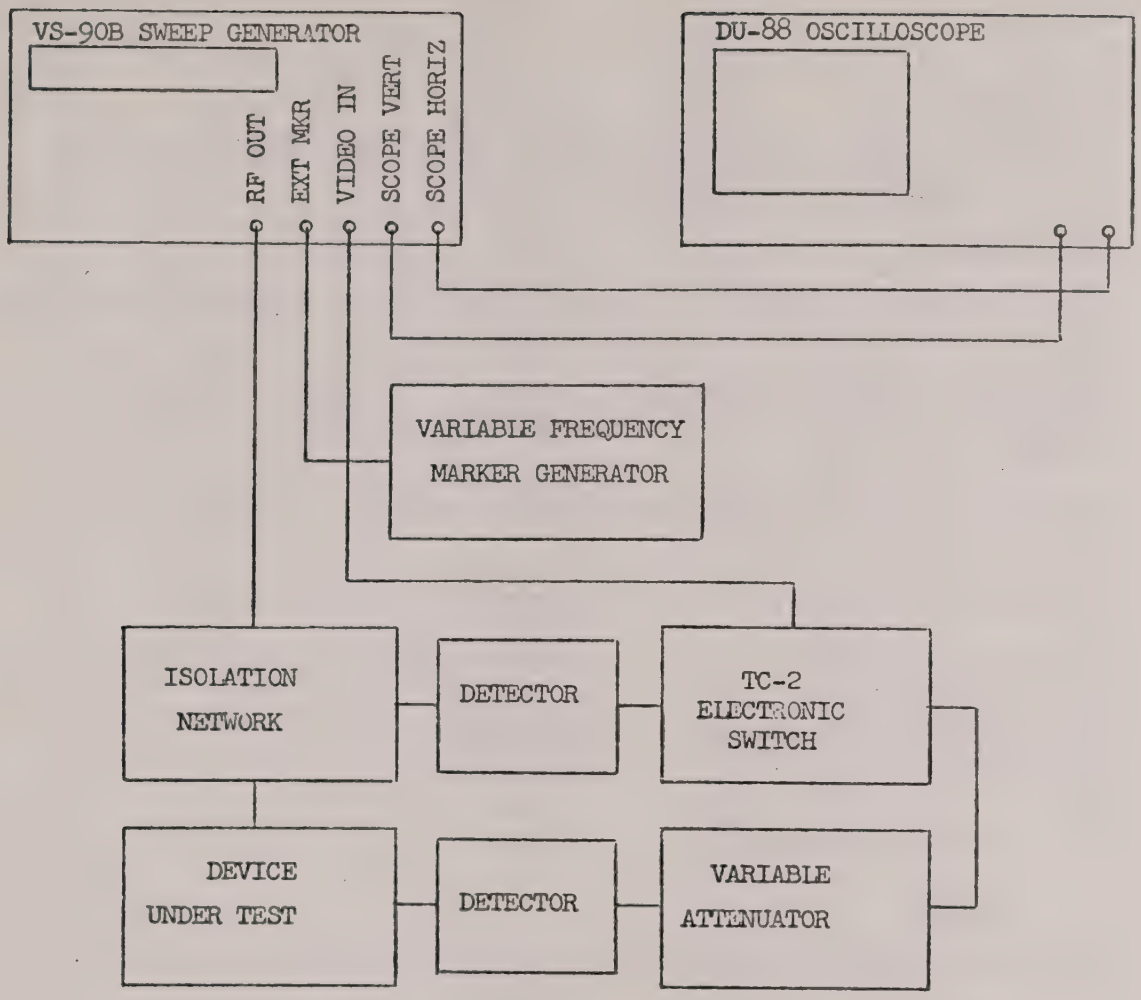


FIGURE 4.1: TEST SETUP

4.3.6

Adjust the variable attenuator until the output swept trace crosses the input swept trace at the frequency of interest.

4.3.7

The attenuation reading is the amplifier gain at the frequency of interest.

NOTE: If the amplifier to be tested has AC power at the input or output terminals, the use of AC blocking network will be required at the following locations. Output of the amplifier and input of line power supply.

Additional equipment required. This equipment will be required for all of the following tests.

Calibrated Attenuators	Texscan KFP Series or LA series or equivalent
Calibrated mismatches	Texscan MF Series or equivalent
Calibrated RF source	
Electronic Switch	Jerrold/Texscan TC-2 or equivalent
Calibrated phase shifter	(Special)
AC Blocking Network	Texscan DB-50 or DB-75

4.4 ANTENNA MEASUREMENTS

4.4.1

Perform the preliminary setup and calibration. See Figure 3.4.

4.4.2

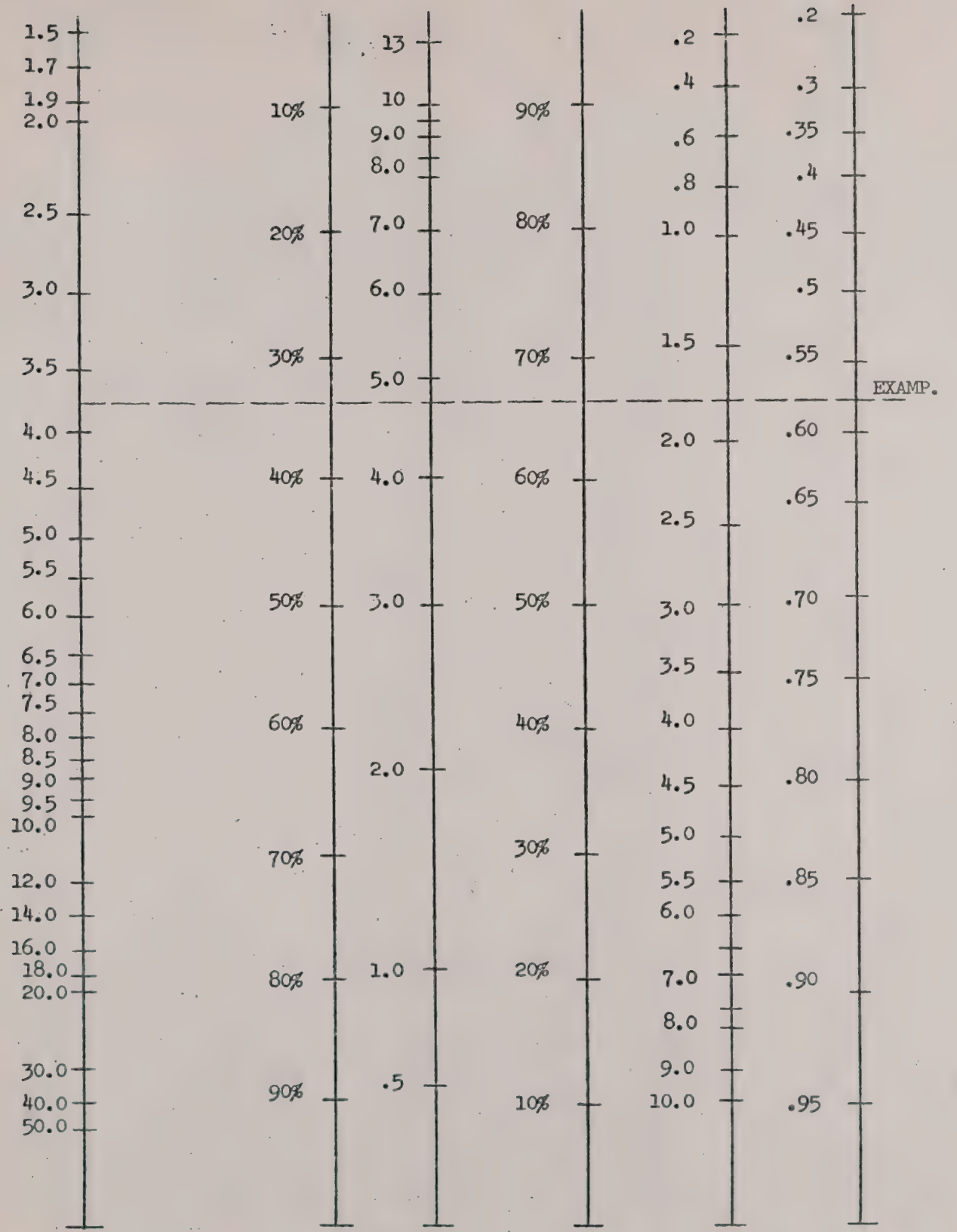
Connect the antenna to be tested to Z2.

4.4.3

Read the VSWR from the oscilloscope.

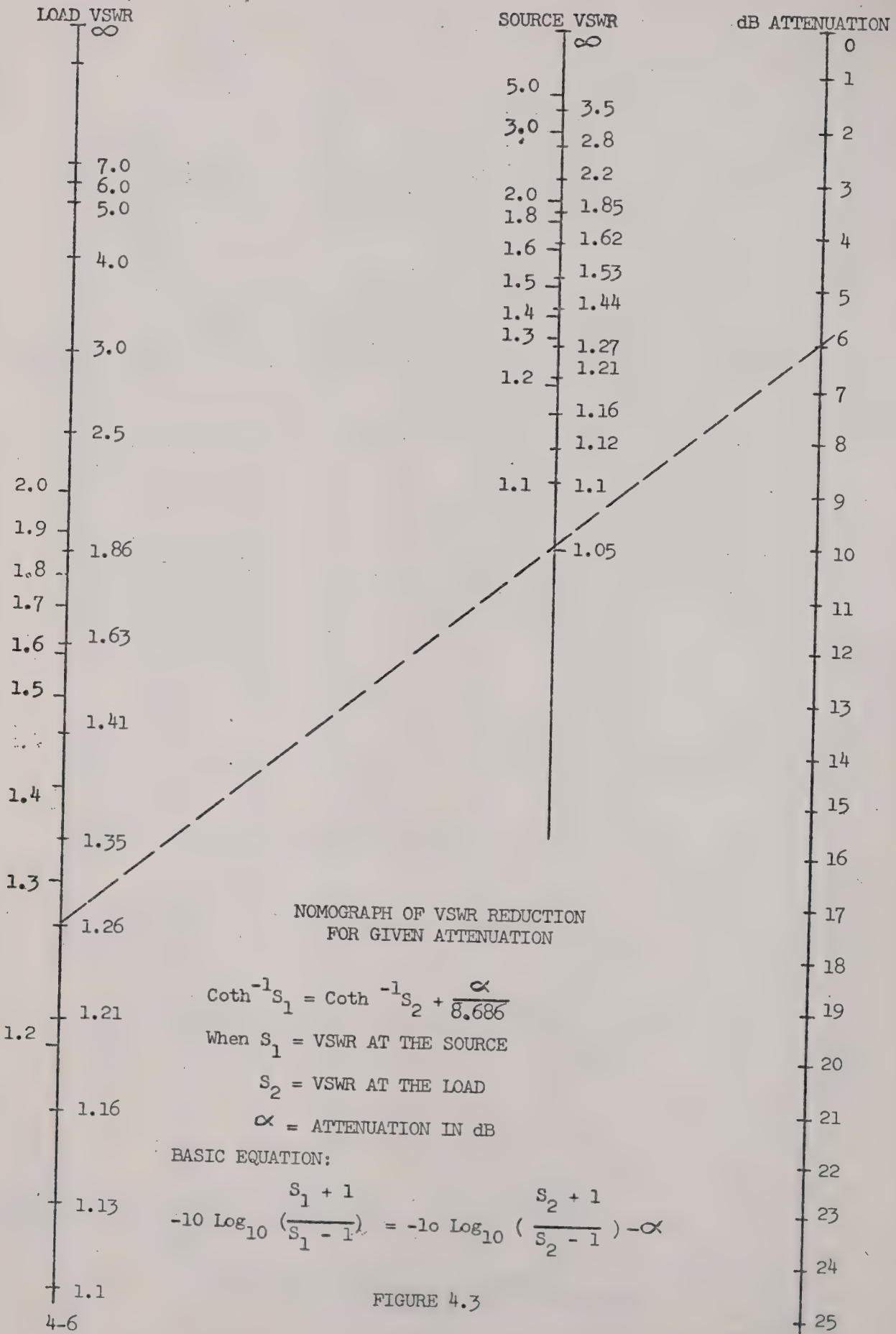
4.4.4

Insert markers to determine the frequency versus VSWR characteristics of the antenna under test.



PARAMETERS RELATED TO VSWR
READ PARAMETERS HORIZONTALLY (-----) EXAMP.

FIGURE 4.2



NOMOGRAPH OF VSWR REDUCTION
FOR GIVEN ATTENUATION

$$\text{Coth}^{-1} S_1 = \text{Coth}^{-1} S_2 + \frac{\alpha}{8.686}$$

When S_1 = VSWR AT THE SOURCE

S_2 = VSWR AT THE LOAD

α = ATTENUATION IN dB

BASIC EQUATION:

$$-10 \text{ Log}_{10} \left(\frac{S_1 + 1}{S_1 - 1}\right) = -10 \text{ Log}_{10} \left(\frac{S_2 + 1}{S_2 - 1}\right) - \alpha$$

FIGURE 4.3

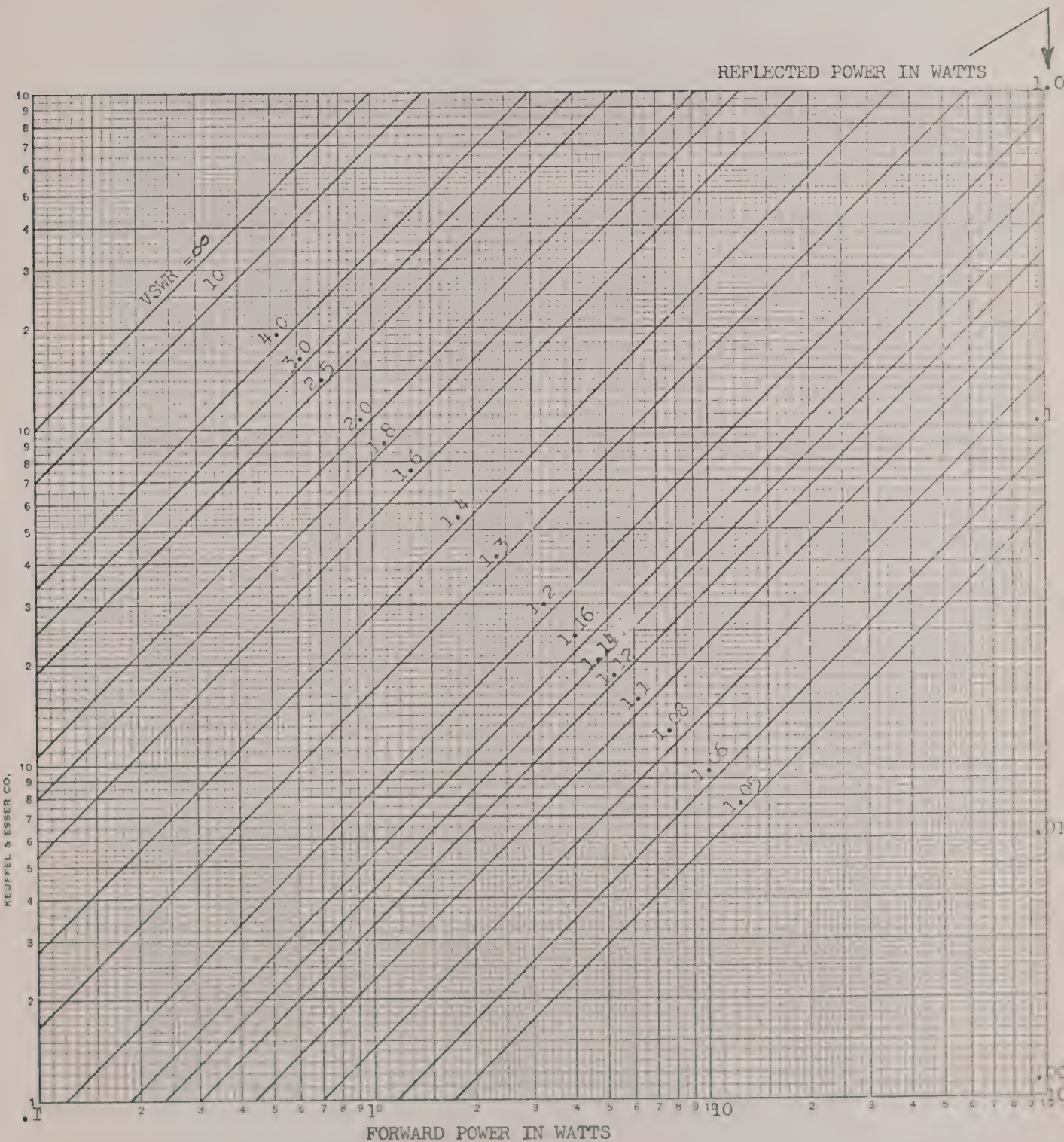


FIGURE 4.4: POWER VALUES vs VSWR

4.4.5

If the length of cable between the antenna and the RCB is great, the apparent VSWR at the bridge is not true antenna VSWR. Refer to Figure 4.3 for VSWR reduction versus cable attenuation. A method of determining cable attenuation is provided in a following section. Manufacturers data may also be consulted for attenuation characteristics of a particular cable.

Consult Figure 4.4 for correlation of power loss due to VSWR.

4.5 STRUCTURAL RETURN LOSS OF CABLE

Structural return loss (SRL) is caused by imperfections in cable construction. Reflections occur from variations in cable diameter, dielectric inperfections, sharp bends, conductor misplacement etc. These reflections prevent a certain portion of the incident power from reaching the load. Structural return loss is a measure of the quality of a cable.

NOTE: Structural return loss and load mismatch constitute return loss. The cable must be terminated properly to eliminate mismatch errors from an SRL measurement.

4.5.1

Perform the initial setup and calibration. See Figure 3.4.

4.5.2

Terminate the cable in its characteristic impedance.

4.5.3

Connect the cable to Z2.

4.5.4

Measure the VSWR at the frequency desired.

4.5.5

Refer to Figure 4.5 and read SRL in terms of observed VSWR.

NOTE: The signal must be leveled at the bridge input to maintain a 50 ohm source impedance. If the sweep generator is leveled internally, and not at the bridge input, the source impednace of the bridge is 83.3 ohms.

SRL = 20 Log $\frac{\text{V reflected}}{\text{V reference}}$ Loss = -10 Log $\frac{\text{VSWR-1}}{\text{VSWR+1}}$

$\frac{\text{V reflected}}{\text{V reference}}$	SRL dB	VSWR	VSWR	INSERTION LOSS
1.12	1	17.40	1.05	-16.3
1.26	2	8.72	1.1	-13.2
1.413	3	5.85	1.2	-10.4
1.585	4	4.42	1.3	- 8.7
1.778	5	3.57	1.4	- 7.8
1.995	6	3.00	1.5	- 7.0
2.239	7	2.62	1.6	- 6.4
2.512	8	2.32	1.7	- 5.9
2.818	9	2.10	1.8	- 5.5
3.162	10	1.92	1.9	- 5.1
3.584	11	1.78	2.0	- 4.8
3.981	12	1.67	2.5	- 3.7
4.467	13	1.58	3.0	- 3.0
5.013	14	1.50	3.5	- 2.6
5.623	15	1.43	4.0	- 2.2
6.310	16	1.38	4.5	- 1.9
7.079	17	1.33	5	- 1.8
7.943	18	1.29	6	- 1.5
8.931	19	1.25	7	- 1.2
10.00	20	1.22	8	- 1.1
11.22	21	1.20	9	- .96
12.59	22	1.17	10	- .88
14.13	23	1.15	20	- .43
15.85	24	1.13	30	- .29
17.78	25	1.12	40	- .23
19.95	26	1.11		
22.39	27	1.09		
25.12	28	1.08		
28.18	29	1.07		
31.62	30	1.06		
35.48	31	1.058		
39.81	32	1.051		
44.67	33	1.046		
50.12	34	1.041		
56.23	35	1.036		
63.10	36	1.032		
70.79	37	1.029		
79.43	38	1.026		

FIGURE 4.5: TABLE OF STRUCTURAL RETURN LOSS & INSERTION LOSS VS. VSWR

4.6 INSERTION LOSS

In cables, insertion loss is comprised of resistive losses (skin effect) and dielectric losses. Each of these parameters increases with frequency. In filters the lumped constants have similar losses. The insertion loss may be determined by observing the reflection from an open or short circuit output. The initial assumption is that the cable or device is matched to the generator.

4.6.1

Perform the initial setup and calibration.

4.6.2

Open circuit (or short circuit) one end of the device.

4.6.3

Connect the device to Z2.

4.6.4

Read the VSWR at the desired frequency.

4.6.5

Refer to Figure 4.5 for correlation of VSWR to insertion loss.

4.7 DETERMINATION OF AMPLITUDE AND PHASE MEASUREMENT

4.7.1

Set up the equipment as shown in Figure 4.6.

NOTE: A dual trace oscilloscope may be used instead of an electronic switch, however, only one channel will have marker capability. This provides simultaneous monitoring of input and output characteristics for matching purposes.

4.7.2

Remove both the known and unknown devices, connecting the attenuators directly to the RCB.

4.7.3

Adjust the variable attenuator and variable phase shifter to obtain a null in output from RCB-2.

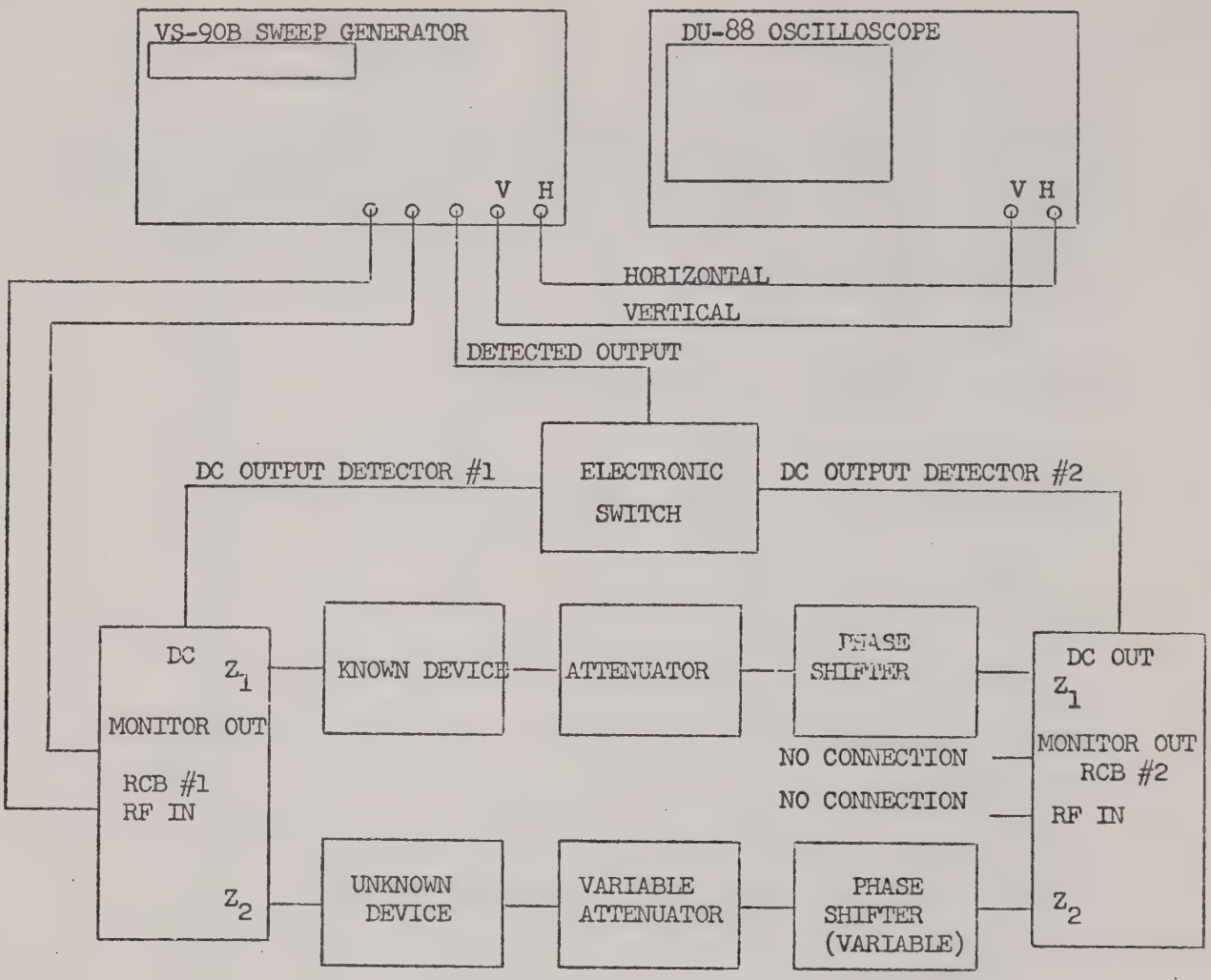


FIGURE 4-6: SETUP FOR DETERMINING AMPLITUDE AND PHASE CHARACTERISTICS

4.7.4

Insert the known and unknown devices per Figure 4.6.

4.7.5

Adjust the device under test (unknown) until a null is observed at the frequency of interest. The unknown device will now match the known device in attenuation and phase angle.

a. Adjust the variable attenuator and variable phase shifter to obtain a null from RCB-2. The difference in attenuation between the fixed attenuator and the variable attenuator indicates attenuation or gain of the device under test. The difference between the fixed phase shifter and the variable phase shifter is the phase shift induced by the device under test.

POSSIBLE APPLICATION: Alignment of 0 phase shift filters; comparison of filter attenuation and phase to a Quality Assurance Standard, or other specifications.

Adjustment of amplifiers for gain and phase shift.

SECTION 5

ALIGNMENT AND ADJUSTMENT PROCEDURE

5.1 INTRODUCTION

The VS-90B is completely aligned and adjusted prior to shipment. However, due to aging or replacement of components, certain adjustments may become necessary in the field. The following adjustments are readily performed in the field using normally available test equipment and techniques. Those sections of the VS-90B not specifically mentioned require special equipment and techniques for alignment and are beyond the scope of this manual.

Test Equipment Required

VTVM or DVM
Oscilloscope
Marker generator or frequency meter

NOTE: All adjustments are to be made with the unit set up per Figure 3.3, except the device under test is omitted and the RF OUT is connected to the VIDEO IN through a CD-51 detector.

5.2 POWER SUPPLY (See Figure 6.2)

5.2.1

+30V DC regulated.

5.2.1.1

Connect a voltmeter between the collector of Q4 and ground.

Select R8 to provide an output voltage of +30V DC ± 1V DC.

5.2.1.2

Adjust R8 to a lower value for higher output voltage. Adjust R8 to a higher value for lower output voltage.

5.2.2

+15V DC regulated.

5.2.2.1

Connect a voltmeter between the positive end of C7 and ground.

5.2.2.2

Adjust the value of R11 for an output of +15V DC ±1V. Decreasing the value of R11 increases the output voltage, and increasing the value of R11 decreases the output voltage.

5.2.3

-30 V DC regulated.

5.2.3.1

Connect a voltmeter between the collector of Q9 and ground. Select R24 to provide an output voltage of -30V DC ±1V DC.

5.2.3.2

Adjust R24 to a lower value for higher output voltage. Adjust R24 to a higher value for lower output voltage.

5.2.4

-15V DC regulated.

5.2.4.1

Connect a voltmeter between the negative end of C17 and ground.

5.2.4.2

Adjust the value of R26 to produce an output voltage of -15V ±1V. Increasing the value of R26 decreases the output voltage, and decreasing the value of R26 increases the output voltage.

5.2.5

0 to -5V DC supply. The 0 to -5V DC supply is adjusted by R34. Measure the voltage between the junction of R38 and R39 and ground. Set the output voltage to -3.2V ±.1V.

5.2.6

The remainder of the supply voltages are non-adjustable.

5.3 RATE CIRCUITRY (See Figure 6.1)

5.3.1 Preliminary Adjustment

5.3.1.1

Connect an oscillosocpe vertical input to the SCOPE HORIZ connector on the front panel.

5.3.1.2

Set the oscilloscope to display the triangular wave. (Use oscilloscope internal time base.)

5.3.1.3

Set the oscilloscope to DC coupling and a scale sensitivity to display a 24V peak-to-peak waveform.

5.3.1.4

Adjust R102, the ramp offset, for a waveform symmetrical about 0V DC.

5.3.1.5

Adjust R108, the RAMP AMP control for a triangular wave of + and -12V DC symmetrical about 0V DC.

5.3.1.6

Set the SWEEP RATE switch (FP) to LINE.

5.3.1.7

Adjust R125, the LINE SYNC control, for a waveform of 24V peak-to-peak symmetrical about 0V DC.

5.3.2

Final adjustment.

5.3.2.1

Set the SWEEP RATE to MANUAL.

5.3.2.2

Return the test setup to that of Figure 3.3.

5.3.2.3

Rotate the SWEEP RATE control from max clockwise to max counterclockwise.

5.3.2.4

Adjust the oscilloscope gain such that when the SWEEP RATE control is at max counterclockwise the intensity dot is on the left edge of the graticule and when the SWEEP RATE control is max clockwise, the intensity dot is on the right edge of the graticule.

5.3.2.5

Set the SWEEP RATE switch to LINE.

5.3.2.6

Adjust R125 until the trace crosses the complete graticule from left to right.

5.3.2.7

Set the SWEEP RATE switch to 5-60 Hz.

5.3.2.8

Set the SWEEP RATE control to max clockwise.

5.3.2.9

Adjust R108, the RAMP AMP control, until the trace crosses the complete graticule.

5.3.2.10

Activate an internal marker.

5.3.2.11

Adjust the CENTER FREQUENCY control to center the zero frequency marker on the graticule.

5.3.2.12

Adjust the SWEEP WIDTH control counterclockwise, narrowing the sweep.

5.3.2.13

Adjust R102, the RAMP OFFSET control to keep the marker centered in the graticule while the SWEEP WIDTH control is varied throughout its range.

This completes the alignment of the rate circuits.

5.4 LINEARITY CIRCUITS (See Figure 6.1)

5.4.1

Connect the VS-90B per Figure 3.3 except eliminate the device under test.

5.4.2

Set the SWEEP RATE switch to 5-60 Hz.

5.4.3

Set the SWEEP RATE control to max clockwise.

5.4.4

Set the SWEEP WIDTH switch to WIDE.

5.4.5

Set the SWEEP WIDTH control to max clockwise.

5.4.6

Set the BAND switch to highest frequency range, and the CENTER FREQUENCY control band center (1800 MHz).

5.4.7

Activate the 100 MHz frequency markers.

5.4.8

Activate the external marker generator at 1250 or 2350 MHz, or use any other means to identify the band-limit frequency.

5.4.9

Adjust R136 the LINEARITY DRIVE SIZE control until the full frequency range of 1250 MHz to 2350 MHz is displayed.

5.4.10

Set the SWEEP WIDTH control to maximum counterclockwise.

5.4.11

Set the CENTER FREQUENCY control to 1250 MHz.

5.4.12

Set the external marker at 1250 MHz.

5.4.13

Adjust R167, the high-band low center-frequency limit, to center the 1250 MHz marker in the graticule.

5.4.14

Set the CENTER FREQUENCY control to 2350 MHz.

5.4.15

Set the external marker at 2350 MHz.

5.4.16

Adjust R152, the high-band high center-frequency limit, to center the 2350 MHz marker in the graticule.

5.4.17

Repeat 5.4.11 through 5.4.16 until the 1250 MHz and 2350 MHz markers center in the display.

5.4.18

With BAND switch set to 750 to 1300 MHz position, and CENTER FREQUENCY dial at approximately 1000 MHz, adjust R169 for a 550 MHz sweep width (750 to 1300 MHz).

5.4.19

Calibrate the CENTER FREQUENCY dial in 750 to 1300 MHz position using the technique in 5.4.10 through 5.4.17. Use R166 to align dial at 750 MHz, and R151 to align dial at 1300 MHz.

5.4.20

With BAND switch set to 5 to 800 MHz position, and CENTER FREQUENCY dial at approximately 400 MHz, adjust R168 for a 795 MHz sweep width (5 to 800 MHz). Use zero-beat notch to identify frequency.

5.4.21

Calibrate the CENTER FREQUENCY dial in 5 to 800 MHz position using technique in 5.4.10 through 5.4.17. Use R165 to align dial at 5 MHz, and R149 to align dial at 800 MHz.

This completes the adjustment of the linearity circuit.

5.5 1 kHz MODULATOR (See Figure 6.1)

5.5.1

Connect an oscilloscope to pin 2 of IC102.

5.5.2

Turn on 1 kHz MOD switch (F.P. - Pull) and observe a +30 volt peak square wave.

5.5.3

Adjust R117, the balance control, for equal dwell time (500 us) at the +30 and 0 volt levels.

NOTE: Some retouching of R118 and 119 may be required due to interaction.

5.6 MARKER AMPLIFIER (See Figure 6.3)

5.6.1

R305 controls the output of the marker in J301.

5.6.2

R306 controls the output of the marker in J302.

5.6.3

R311 controls the output of the marker in J303.

5.6.4

R312 controls the output of the marker in J304.

NOTE: For ease of marker identification, it is suggested that amplitudes be adjusted to correspond to frequency. (i.e., 50 MHz harmonic largest, 10 MHz harmonic, middle, 1 MHz harmonic smallest.)

5.7 RF LEVEL ADJUSTMENT (See Figure 6.1)

5.7.1

Set the VS-90B to sweep 1250 to 2350 MHz.

5.7.2

Set RF LEVEL to max counterclockwise.

5.7.3

Adjust RF LEVEL CAL MIN control R155 until the detected display is approximately 0.4 volts from the base line.

5.7.4

Adjust R602, the DIODE BIAS NO. 3 control, for a condition where leveling just occurs across the range of 1250 to 2350 MHz.

NOTE: Some frequency pulling occurs with adjustment of R602. The setting of R602 is a compromise between leveling and frequency pulling.

5.7. 5

With both ATTENUATORS set to 0 dB, set the RF LEVEL control to max clockwise.

5.7.6

Adjust R156, the RF LEVEL CAL MAX control, for an output of 0.7V rms, or approximately 0.81 volts using a Texscan CD-51 detector.

5.7.7

Set the ATTENUATION to 6 dB, and note the position of the trace.

5.7.8

Set the RF LEVEL control to max counterclockwise.

5.7.9

Adjust R155, the RF LEVEL CAL MIN control, for an output at the level in 5.7.7 (-6 dB).

5.7.10

Repeat steps 5.7.5 through 5.7.9 as required to obtain the MAX and MIN RF levels without adjusting R155 and R156.

5.7.11

Repeat 5.7.1 through 5.7.4 for middle band using R601, and for low band using R600. Leveler recalibration (5.7.5 through 5.7.10) should not be required.

This completes the VS-90B adjustment procedure.

SECTION 6

DOCUMENTATION

6.1 VS-90B PARTS LIST

6.2 SCHEMATIC DIAGRAMS

VS-90B PARTS LIST

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION
		ATTENUATORS
AT471	A204-613	Attenuator
AT472	(See FL472)	Factory Selected Value
AT481	A200-272	MA-51
AT482	A200-271	MA-50
		CAPACITORS
C1	012-214	1500uF/50V
C2	012-231	400uF/90V
C3	012-007	20pF
C4	012-064	25uF/25V
C5	012-064	25uF/25V
C6	012-132	.1uF
C7	012-113	350uF/15V
C8	012-033	470pF
C9	012-033	470pF
C10	012-237	140uF/90V
C11	012-214	1500uF/50V
C12	012-231	400uF/90V
C13	012-007	20pF
C14	012-064	25uF/25V
C15	012-064	25uF/25V
C16	012-132	.1uF
C17	012-113	350uF/150V
C18	012-033	470pF
C21	012-132	.1uF
C22	012-033	470pF
C23	012-009	1000pF/500V
C24	012-143	220pF
C25	012-225	50uF/250V
C26	012-212	200uF/150V
C101	012-271	.22uF
C102	012-050	.01uF/100V
C103	012-069	.0015uF
C104	012-069	.0015uF
C105	012-269	.1uF/100V
C106	012-131	3.3uF/35V
C107	012-272	.68uF/100V
C108	012-131	3.3uF/35V
C109	012-033	470pF
C111		Factory Selected Value
C112	012-050	.01uF/100V
C113	012-131	3.3uF/35V
C114	012-272	.68uF/100V
C115	012-243	.33uF/100V
C116	012-232	10uF/150V

CAPACITORS - continued

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION
C117	012-060	100pF/15V
C118	012-050	.01uF/100V
C119	012-009	1000pF/500V
C201	012-033	470pF
C202	012-132	.1uF
C203	012-212	200uF/15V
C205	012-057	7pF
C301	012-050	.01uF/100V
C302	012-050	.01uF/100V
C303	012-050	.01uF/100V
C304	012-050	.01uF/100V
C305	012-050	.01uF/100V
C306	012-050	.01uF/100V
C307	012-009	1000pF/500V
C308	012-009	1000pF/500V
C309	012-009	1000pF/500V
C310	012-009	1000pF/500V
C311	012-050	.01uF/100V
C312	012-050	.01uF/100V
C313	012-009	1000pF/500V
C314	012-050	.01uF/100V
C315	012-013	120pF/100V
C316	012-220	50uF/50V
C351	012-001	1000pF/Feedthru
C471	012-106	1000pF
C472	012-106	1000pF
C473	012-239	100pF
C474	012-239	100pF
C475	012-239	100pF
C481	012-256	1000pF/Feedthru
C501	012-001	1000pF
C502	012-129	22pF
C503		Factory Selected Value
C504	015-013	Variable, VC-20GY
C505	015-013	Variable, VC-20GY
C506		Factory Selected Value
C507	012-256	1000pF
C508	012-129	22pF
C509	012-213	1000pF
C510	012-001	1000pF
C551	012-058	120pF
C552	012-036	470pF
C553		Factory Selected Value
C554	012-246	27pF
C555		Factory Selected Value
C556		Factory Selected Value
C557	012-246	27pF

CAPACITORS - continued

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION
C558	012-090	2.4pF
C559	012-058	120pF
C560		Factory Selected Value
C601	012-058	120pF
C602	012-058	120pF
C603	012-058	120pF
C604	012-058	120pF
C605	012-036	470pF
C606	012-058	120pF
C607	012-036	470pF
C608	012-058	120pF
C609	012-250	8pF
C611	012-250	8pF
C612	012-213	1000pF
C613	012-213	1000pF
C614	012-213	1000pF
C615	012-217	1000pF
C616	012-090	2.4pF
C801	012-217	.001uF
C802	012-219	500pF
C803	012-217	.001uF
C804	012-247	10pF
C805	012-217	.001uF
C806	012-219	500pF
C807	012-217	.001uF
C808	012-247	10pF
C809	012-089	2.0pF
C810	012-217	.001uF
C811	012-219	500pF
C812		Factory Selected Value
C813	012-247	10pF
C814	012-217	.001uF
C815	012-217	.001uF
C817	012-219	500pF
C818		Factory Selected Value
C819	012-246	27pF
C820	012-217	.001uF
C821	012-217	.001uF
C822	012-217	.001uF
C823	012-217	.001uF
C824		Factory Selected Value
C825	012-246	27pF
C826		Factory Selected Value
C827	012-217	.001uF
C828	012-106	.001uF
C829	012-106	.001uF
C830	012-106	.001uF
C831	012-227	220pF

CAPACITORS - continued

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION
C832		Factory Selected Value
C833	012-218	220pF
C834	012-092	5pF Disc.
C835	012-217	.001uF
C836		Factory Selected Value
C837	012-057	7pF Disc.
C838	012-030	27pF Disc.
C840	012-217	.001uF
C841	012-050	01uF/100V
C842		Factory Selected Value
C844	012-057	7pF Disc.
C848	012-110	150uF/35V
C849	012-132	1uF/100V
C851	012-217	.001uF

DIODES

CR1	025-077	Bridge W06
CR2	025-077	Bridge W06
CR3	025-077	Bridge W06
CR101	025-034	IN457A
CR102	025-086	IN4446
CR103	025-086	IN4446
CR201	025-086	IN4446
CR202	025-086	IN4446
CR203	025-086	IN4446
CR204	025-086	IN4446
CR205	025-086	IN4446
CR206	025-086	IN4446
CR207	025-086	IN4446
CR208	025-086	IN4446
CR209	025-086	IN4446
CR210	025-086	IN4446
CR251	025-086	IN4446
CR252	025-086	IN4446
CR253	025-086	IN4446
CR254	025-086	IN4446
CR255	025-086	IN4446
CR256	025-086	IN4446
CR257	025-086	IN4446
CR258	025-086	IN4446
CR259	025-086	IN4446
CR260	025-086	IN4446
CR301	025-034	IN457A
CR302	025-034	IN457A
CR351	025-002	IN82AG
CR471	025-063	MO111AM
CR472	025-063	MO111AM
CR473	025-063	MO111AM

DIODES - continued

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION
CR481	025-082	MA41500
CR501	025-070	PIN IN100
CR502	025-070	PIN IN100
CR503	025-002	IN82AG
CR504	025-002	IN82AG
CR505	025-002	IN82AG
CR506	025-002	IN82AG
CR507	025-070	PIN IN100
CR551	025-044	E-8
CR552	025-044	E-8
CR601	025-090	MM6601A
CR602	025-090	MM6601A
CR603	025-090	MM6601A
CR604	025-044	E-8
	VARACTORS	
CV551	064-017	MV1860D
CV552	064-017	MV1860D
CV601	064-017	MV1860D
CV602	064-017	MV1860D
	FUSES	
F1	034-008	1 Amp, S10B1 For 115V Impt.
	FILTERS	
FL471	B071-028-01	Low Pass
FL472	A204-529-01	Band Pass
FL501	A071-013-01	Low Pass
FL601	B071-017-05	Low Pass
	BULBS	
I1	011-007	6.3V
I2	011-007	6.3V
I3	011-007	6.3V
I4	011-007	6.3V
I5	011-007	6.3V
I6	011-007	6.3V
I7	011-007	6.3V
I8	011-007	6.3V
I9	011-007	6.3V
I10	011-007	6.3V
I11	011-007	6.3V
I12	011-007	6.3V

BULBS - continued

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION
I13	011-007	6.3V
I701	011-007	Dial, 6.3V
I702	011-007	Dial, 6.3V
I703	011-007	Dial, 6.3V
I704	011-007	Dial,6.3V
I705	011-007	Dial, 6.3V
I706	011-007	Dial, 6.3V
I707	011-007	Dial, 6.3V
I708	011-007	Dial, 6.3V
I709	011-007	Dial, 6.3V
I710	011-007	Dial, 6.3V
I711	011-007	Dial, 6.3V
I712	011-007	Dial, 6.3V

INTEGRATED CIRCUITS

IC1	076-002	uA741C
IC2	076-002	uA741C
IC3	076-002	uA741C
IC4	076-013	LN1458
IC101	076-013	LN1458
IC102	076-002	uA741C
IC103	076-002	uA741C
IC201	076-012	uA741KH

CONNECTORS

J101	020-016	RF,5069
J102	020-016	RF,5069
J103	020-016	RF,5069
J301	054-003	Socket, Six Pin
J302	054-003	Socket, Six Pin
J303	054-003	Socket, Six Pin
J304	054-003	Socket, Six Pin
J305	020-016	RF,5069
J306	020-016	RF,5069
J351	020-016	RF,5069
J352	020-032	RF,5327
J353	020-032	RF,5327
J481	B020-097-01	RF,TNC
J482	B020-097-01	RF,TNC
J483	B020-097-01	RF,TNC
J485	B020-097-01	RF,TNC
J486	B020-097-01	RF,TNC
J487	020-166	RF,Bulkhead,Feedthru
J801	020-030	UG185/u
J802	020-030	UG185/u

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION
		INDUCTORS
L301	035-007	10mH
L471	035-045	.39uH
L472	035-045	.39uH
L473	035-045	.39uH
L501	035-045	.39uH
L502	035-045	.39uH
L503		Factory Selected Value
L504		Factory Selected Value
L505	035-045	.39uH
L506	035-045	.39uH
L551	035-045	.39uH
L552		Factory Selected Value
L553	035-045	.39uH
L554	035-004	.68uH
L555	035-004	.68uH
L556	035.045	.39uH
L557	035-041	100uH
L601	035-004	.68uH
L602	035-010	6.8uH
L603	A035-104	Factory Selected Value
L604	A035-105	Factory Selected Value
L605	A035-106	Factory Selected Value
L606		Factory Selected Value
L607	035-001	1uH
L608	035-001	1uH
L609	A035-103	Factory Selected Value
L801		Factory Selected Value
L802		Factory Selected Value
L803		Factory Selected Value
L804		Factory Selected Value
L805		Factory SelectedValue
L806	A035-054	Factory Selected Value
L807		Factory Selected Value
L808		Factory Selected Value
L809	A035-054	Factory Selected Value
L810		Factory Selected Value
L811		Factory Selected Value
L812	A035-054	Factory Selected Value
L813		Factory Selected Value
L814		Factory Selected Value
L815	A035-054	Factory Selected Value
L816	035-002	2.2uH
L817		Factory Selected Value
L818	A035-054	Factory Selected Value
L819		Factory Selected Value
L820	A035-054	Factory Selected Value
L821	035-024	.22uH

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION
		CONNECTORS
P1	019-004	Line Cord and Plug
P351	020-133	BNC,UG-88c/u
P352	020-155	TNC,8001
P353	020-155	TNC,8001
P354	020-133	BNC,UG88c/u
P461	020-155	TNC,8001
P462	020-111	OSM
P471	020-155	TNC,8001
P472	020-111	OSM
P481	020-164	RF,Plug
P482	020-165	RF,Plug
P483	020-165	RF,Plug
P484	020-165	RF,Plug
P485	020-165	RF,Plug
P801	020-133	BNC,UG-88c/u
P802	020-111	OSM
P803	020-133	BNC,UG-88c/u
P804	020-155	TNC,8001
		TRANSISTORS
Q1	062-076	MJE1100
Q2	062-005	2N3053
Q3	062-010	2N3638
Q4	062-076	MJE1100
Q5	062-015	2N3568
Q6	062-075	MJE1090
Q7	062-024	2N3644
Q8	062-010	2N3638
Q9	062-053	2N4919
Q10	062-015	2N3568
Q11	062-024	2N3644
Q12	062-024	2N3644
Q13	062-053	2N4914
Q14	062-055	MJE340
Q15	062-012	2N4221
Q101	062-015	2N3568
Q102	062-015	2N3568
Q103	062-076	MJE1100
Q104	062-005	2N3053
Q201	062-061	2N4889
Q202	062-061	2N4889
Q203	062-064	MM4003
Q301	062-024	2N3644
Q302	062-024	2N3644
Q303	062-024	2N3644
Q305	062-024	2N3644

TRANSISTORS - continued

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION
Q306	062-012	2N4221
Q501	062-047	SE3005
Q551	062-057	40836
Q552	062-057	40836
Q601	062-078	2SC1251
Q602	062-078	2SC1251

RESISTORS

R1	047-523	1 ohm, 2W, 10%
R2	047-049	1 ohm, $\frac{1}{2}$W, 10%
R3	046-396	470 ohm, 1W, 10%
R4	045-710	1K ohm, $\frac{1}{4}$W, 10%
R5	047-462	1K ohm, 1%
R6	047-462	1K ohm, 1%
R7	047-435	5.62K ohm, 1%
R8		Factory Selected Value
R9		Factory Selected Value
R10	047-528	68 ohm, 3W, 10%
R11	047-452	15K ohm, 1W, 1%
R12	047-452	15K ohm, 1W, 1%
R13	045-777	39K ohm, $\frac{1}{2}$W, 10%
R14	047-479	1 ohm, $\frac{1}{2}$W, 10%
R15	045-752	10K ohm, $\frac{1}{4}$W, 10%
R16	047-480	2.2 ohm, $\frac{1}{2}$W, 1%
R17	047-479	1 ohm, $\frac{1}{2}$W, 10%
R19	045-710	1K ohm, $\frac{1}{4}$W, 10%
R21	047-762	1K ohm, 1W, 1%
R22	047-762	1K ohm, 1W, 1%
R23	047-435	5.62K ohm, 1%
R24		Factory Selected Value
R25		Factory Selected Value
R26	047-452	15K ohm, 1W, 1%
R27	047-452	15K ohm, 1W, 1%
R28	045-766	22K ohm, $\frac{1}{4}$W, 10%
R29	045-602	2.7K, $\frac{1}{4}$W, 10%
R31	045-752	10K, $\frac{1}{4}$W, 10%
R33	047-489	33.2K ohm, 1%
R34	048-161	Variable, 10K ohm
R35	045-766	22K, $\frac{1}{4}$W, 10%
R36		Factory Selected Value
R37	045-602	2.7K ohm, $\frac{1}{4}$W, 10%
R38	045-752	10K ohm, $\frac{1}{4}$W, 10%
R39		Factory Selected Value
R41	046-054	47 ohm, $\frac{1}{2}$W, 10%
R42	046-194	100K ohm, $\frac{1}{2}$W, 10%
R43	046-152	10K ohm, $\frac{1}{2}$W, 10%

RESISTORS - continued

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION
R44	045-682	220 ohm, ½W, 10%
R45	046-194	100K ohm, ½W, 10%
R46	045-703	680 ohm, ¼W, 10%
R47	045-794	100K ohm, ½W, 10%
R48	045-843	1.5M ohm, ¼W, 10%
R49	045-752	10K ohm, ½W, 10%
R51	045-710	1K chm, ½W, 10%
R52	045-710	1K ohm, ½W, 10%
R53	046-068	100 ohm, ½W, 10%
R54	045-602	2.7K ohm, ¼W, 10%
R100	045-826	560K ohm, ¼W, 10%
R102	048-097	Variable 50K
R103	047-452	15K ohm, 1W, 1%
R104	047-462	1K ohm, 1%
R105	045-752	10K, ohm, ¼W, 10%
R106	047-439	8.2K ohm, ¼W, 1%
R107	047-440	10K ohm, ¼W, 1%
R108	048-161	Variable, 10K
R109	045-794	100K ohm, ¼W, 10%
R110	045-780	47K ohm, ¼W, 10%
R111	045-794	100K ohm, ¼W, 10%
R112	045-794	100K ohm, ¼W, 10%
R113	045-763	18K ohm, ¼W, 10%
R114	045-763	18K ohm, ¼W, 10%
R115	045-815	330K ohm, ¼W, 10%
R116	045-815	330K ohm, ¼W, 10%
R117	048-031	Variable, 200K ohm
R118	048-032	Variable, 1M ohm
R119	047-419	7.905 ohm, 1%
R120	045-798	120K ohm, ¼W, 10%
R121	047-503	499 ohm, ¼W, 1%
R122	047-476	4.75K ohm, ¼W, 1%
R123	047-531	6.81K ohm, 1%
R124	045-738	4.7K ohm, ¼W, 10%
R125	048-161	Variable, 10K ohm
R127	045-759	15K ohm, ¼W, 10%
R128	045-710	1K ohm, ¼W, 10%
R129	045-766	22K ohm, ¼W, 10%
R130	045-752	10K ohm, ¼W, 10%
R131	046-152	10K ohm, ½W, 10%
R132	045-780	47K ohm, ¼W, 10%
R133	047-444	33.2K ohm, ¼W, 1%
R134	047-360	12.1K ohm, ½W, 1%
R135	045-794	100K ohm, ¼W, 10%
R136	048-161	Variable, 10K ohm
R137	045-738	4.7K ohm, ¼W, 10%
R139	045-696	470 ohm, ¼W, 10%
R141	047-777	200K ohm, ¼W, 1%

RESISTORS - continued

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION
R145		Factory Selected Value
R146	047-477	200K ohm, $\frac{1}{4}$W, 1%
R147	048-206	Variable, 10K ohm
R148	047-067	1.5K ohm, $\frac{1}{4}$W, 1%
R149	048-122	Variable, 5K ohm
R151	048-122	Variable, 5K ohm
R152	048-122	Variable, 5K ohm
R153	045-752	10K ohm, $\frac{1}{4}$W, 10%
R154/S106/S105	048-059	Variable, 10K ohm
R155	048-036	Variable, 5K ohm
R156	048-036	Variable, 5K ohm
R157	045-752	10K ohm, $\frac{1}{4}$W, 10%
R158	045-742	5.6K ohm, $\frac{1}{4}$W, 10%
R159	045-696	470K ohm, $\frac{1}{4}$W, 10%
R161	045-654	47 ohm, $\frac{1}{4}$W, 10%
R162		Factory Selected Value
R163	045-531	6.8K ohm, $\frac{1}{4}$W, 1%
R164	047-443	22.1K ohm, $\frac{1}{4}$W, 1%
R165	048-120	Variable, 2K ohm
R166	048-120	Variable, 2K ohm
R167	048-120	Variable, 2K ohm
R168	048-024	Variable, 5K ohm
R169	048-125	Variable, 10K ohm
R201	047-462	1K ohm, $\frac{1}{4}$W, 1%
R202	047-251	671 ohm, $\frac{1}{4}$W, 1%
R203	047-438	100K ohm, $\frac{1}{4}$W, 1%
R204	047-438	100K ohm, $\frac{1}{4}$W, 1%
R205	047-251	671K ohm, $\frac{1}{4}$W, 1%
R206	047-449	2K ohm, $\frac{1}{4}$W, 1%
R207	045-731	3.3K ohm, $\frac{1}{4}$W, 10%
R208	045-689	330 ohm, $\frac{1}{4}$W, 10%
R209	046-194	100K ohm, $\frac{1}{2}$W, 10%
R210	046-110	1K ohm, $\frac{1}{2}$W, 10%
R211	047-531	6.81K ohm, $\frac{1}{4}$W, 1%
R212	047-532	6.81K ohm, $\frac{1}{4}$W, 1%
R213	047-477	68.1K ohm, $\frac{1}{4}$W, 1%
R215	047-538	221K ohm, 1%
R216	047-537	182K ohm, 1%
R217	047-536	150K ohm, 1%
R218	047-535	121K ohm, 1%
R219	047-534	100K ohm, 1%
R220	047-539	270K ohm, 1%
R221	047-538	221K ohm, 1%
R222	047-537	182K ohm, 1%
R223	047-536	150K ohm, 1%
R224	047-533	82.5K ohm, $\frac{1}{4}$W, 1%
R225	047-539	270K ohm, 1%

RESISTORS - continued

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION
R226	047-539	270K ohm, 1%
R227	047-539	270K ohm, 1%
R228	047-539	270K ohm, 1%
R229	047-539	270K ohm, 1%
R231	047-540	560K ohm, 1%
R232	047-540	560K ohm, 1%
R233	047-540	560K ohm, 1%
R234	047-540	560K ohm, 1%
R235	047-540	560K ohm, 1%
R236		Factory Selected Value
R251		Factory Selected Value
R252		Factory Selected Value
R253		Factory Selected Value
R254		Factory Selected Value
R255		Factory Selected Value
R256	047-554	75K ohm, $\frac{1}{4}$W, 1%
R257	047-553	82.5K ohm, $\frac{1}{4}$W, 1%
R258	047-535	121K ohm, 1%
R259	047-534	100K ohm, 1%
R261	047-540	150K ohm, 1%
R262	047-539	270K ohm, 1%
R263	047-539	270K ohm, 1%
R264	047-535	121K ohm, 1%
R265	047-533	82.5K ohm, 1%
R267	047-540	560K ohm, 1%
R268	047-540	560K ohm, 1%
R269	047-540	560K ohm, 1%
R271	047-540	560K ohm, 1%
R272	047-540	560K ohm, 1%
R301	045-752	10K ohm, $\frac{1}{4}$W, 10%
R302	045-808	220K ohm, $\frac{1}{4}$W, 10%
R303	045-710	1K ohm, $\frac{1}{4}$W, 10%
R304	045-710	1K ohm, $\frac{1}{4}$W, 10%
R305	048-157	Variable, 10K ohm
R306	048-157	Variable, 10K ohm
R307	045-668	100 ohm, $\frac{1}{4}$W, 10%
R308	045-808	220K ohm, $\frac{1}{4}$W, 10%
R309	045-710	1K ohm, $\frac{1}{4}$W, 10%
R310	045-710	1K ohm, $\frac{1}{4}$W, 10%
R311	048-157	Variable, 10K ohm
R312	048-157	Variable, 10K ohm
R313	045-668	100 ohm, $\frac{1}{4}$W, 10%
R314	045-738	4.7K ohm, $\frac{1}{4}$W, 10%
R315	045-808	220K ohm, $\frac{1}{4}$W, 10%
R316	045-689	330 ohm, $\frac{1}{4}$W, 10%
R317	045-686	270 ohm, $\frac{1}{4}$W, 10%
R318	045-808	220K ohm, $\frac{1}{4}$W, 10%
R319	045-686	270 ohm, $\frac{1}{4}$W, 10%

RESISTORS - continued

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION
R320	045-710	1K ohm, ¼W, 10%
R321	045-752	10K ohm, ¼W, 10%
R322	045-752	10K ohm, ¼W, 10%
R323	045-752	10K ohm, ¼W, 10%
R324/R327A & R327B	A048-158	Variable, 25K/100K/100K
R325	045-836	1M ohm, ¼W, 10%
R326	045-752	10K ohm, ¼W, 10%
R327		(see R324)
R328	046-180	47K ohm, ½W, 10%
R329	045-836	1M ohm, ¼W, 10%
R330	045-857	3.3M ohm, ¼W, 10%
R331	048-057	Variable, 100K ohm
R351	045-682	220 ohm, ¼W, 10%
R352	045-752	10K ohm, ¼W, 10%
R353	045-658	56 ohm, ¼W, 10%
R354	045-658	56 ohm, ¼W, 10%
R355	045-696	470 ohm, ¼W, 10%
R356	045-626	10 ohm, ¼W, 10%
R471	045-356	51 ohm, 1/8W, 10%
R472	045-368	100 ohm, 1/8W, 10%
R473		Factory Selected Value
R474		Factory Selected Value
R475	045-656	51 ohm, ¼W, 5%
R479	045-738	4.7K ohm, ¼W, 10%
R481	045-696	470 ohm, ¼W, 10%
R482	045-368	100 ohm, 1/8W, 10%
R483	045-717	1.5K ohm, ¼W, 10%
R484	045-368	100 ohm, 1/8W, 10%
R485	047-286	50 ohm, 1W, 1%
R486	047-306	96.25 ohm, 1/8W, 1%
R501	047-056	267.73 ohm, ¼W, 1%
R592	047-445	3.92K ohm, ¼W, 1%
R503	047-484	681K ohm, ¼W, 1%
R504	045-654	47 ohm, ¼W, 10%
R505	045-654	47 ohm, ¼W, 10%
R506	045-356	51 ohm, 1/8W, 10%
R507	045-356	51 ohm, 1/8W, 10%
R508	045-356	51 ohm, 1/8W, 10%
R551	045-682	220 ohm, ¼W, 10%
R554	047-527	51 ohm, 3W, 10%
R555	047-527	51 ohm, 3W, 10%
R601	045-626	10 ohm, ¼W, 10%
R602	045-438	4.7K ohm, 1/8W, 10%
R603	045-166	22K ohm, ½W, 10%
R604	045-527	51 ohm, 3W, 10%
R605	045-612	4.7 ohm, 1/4W, 10%

RESISTORS - continued

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION
R607	045-661	68 ohm, ¼W, 10%
R609	045-661	68 ohm, ¼W, 10%
R611	045-347	33 ohm, 1/8W, 10%
R612	045-626	10 ohm, ¼W, 10%
R613	045-654	47 ohm, ¼W, 10%
R614	046-679	180 ohm, 2W, 10%
R617	045-654	47 ohm, ¼W, 10%
R618	048-024	Variable, 5K ohm
R619	048-024	Variable, 5K ohm
R620	048-024	Variable, 5K ohm
R801	045-438	4.7K ohm, 1/8W, 10%
R802	045-396	470 ohm
R803	045-382	220 ohm, 1/8W, 10%
R804	045-326	10 ohm, 1/8W, 10%
R805	045-312	4.7 ohm, 1/8W, 10%
R806	045-365	82 ohm, 1/8W, 10%
R807	045-438	4.7K ohm, 1/8W, 10%
R808	045-396	470 ohm, 1/8W, 10%
R809	045-389	330 ohm, 1/8W, 10%
R810	045-326	10 ohm, 1/8W, 10%
R811	045-326	10 ohm, 1/8W, 10%
R812	045-347	82 ohm, 1/8W, 10%
R813	045-428	2.7K ohm, 1/8W, 10%
R814	045-396	470 ohm, 1/8W, 10%
R815	045-396	470 ohm, 1/8W, 10%
R816	045-326	10 ohm, 1/8W, 10%
R817	045-340	22 ohm, 1/8W, 10%
R818	045-326	10 ohm, 1/8W, 10%
R819	045-431	3.3K ohm, 1/8W, 10%
R820	045-396	470 ohm, 1/8W, 10%
R821	045-414	1.2K ohm, 1/8W, 10%
R822	045-326	10 ohm, 1/8W, 10%
R824	045-347	33 ohm, 1/8W, 10%
R825	045-326	10 ohm, 1/8W, 10%
R826	045-424	2.2K ohm, 1/8W, 10%
R827	045-396	470 ohm, 1/8W, 10%
R828	045-414	1.2K ohm, 1/8W, 10%
R829	045-326	10 ohm, 1/8W, 10%
R830	045-347	33 ohm, 1/8W, 10%
R831	045-752	10K ohm, ½W, 10%
R832	045-640	22 ohm, ¼W, 10%
R833	045-396	470 ohm, 1/8W, 10%
R834	045-738	4.7K ohm, ¼W, 10%
R835	045-689	330 ohm, ¼W, 10%
R836	046-372	120 ohm, 1W, 10%
R837	045-689	330 ohm, ¼W, 10%
R838	045-365	82 ohm, 1/8W, 10%
R839	045-340	22 ohm, 1/8W, 10%

RESISTORS - continued

CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION
R840	045-647	33 ohm, 1/8W, 10%
R841	045-756	12K ohm, $\frac{1}{4}$W, 1%
R842	045-742	5.6K ohm, $\frac{1}{4}$W, 10%
R843	045-340	2.2 ohm, 1/8W, 10%
R844	046-368	100 ohm, 1W, 10%
R845	045-682	220 ohm, $\frac{1}{4}$W, 10%
R846	045-682	220 ohm, $\frac{1}{4}$W, 10%
R847	045-340	22 ohm, 1/8W, 10%
R848	045-400	560 ohm, 1/8W, 10%
R849	045-386	270 ohm, 1/8W, 10%
R850	045-326	10 ohm, 1/8W, 10%
R851	045-326	10 ohm, 1/8W, 10%
R852	045-054	47 ohm, $\frac{1}{2}$W, 10%

SWITCHES

S1	057-058	Pushbutton 2P2T
S101/R138	B057-146	4PBP 500/5K ohm
S102	057-003	2P2P
S103/R154	B057-110	6P5P, 5K/500K ohm
S104	A204-480	Band/Monitor Assembly
S105		See S103
S301	057-056	Pushbutton, 8 Station
S302	057-056	Pushbutton, 8 Station
S303	057-056	Pushbutton, 8 Station
S304	057-056	Pushbutton, 8 Station
S305	057-056	Pushbutton, 8 Station
S306	057-056	Pushbutton, 8 Station
S307	057-056	Pushbutton, 8 Station
S308	057-056	Pushbutton, 8 Station

TRANSFORMER

T1	B061-034	Transformer, Power

DIODE ZENER

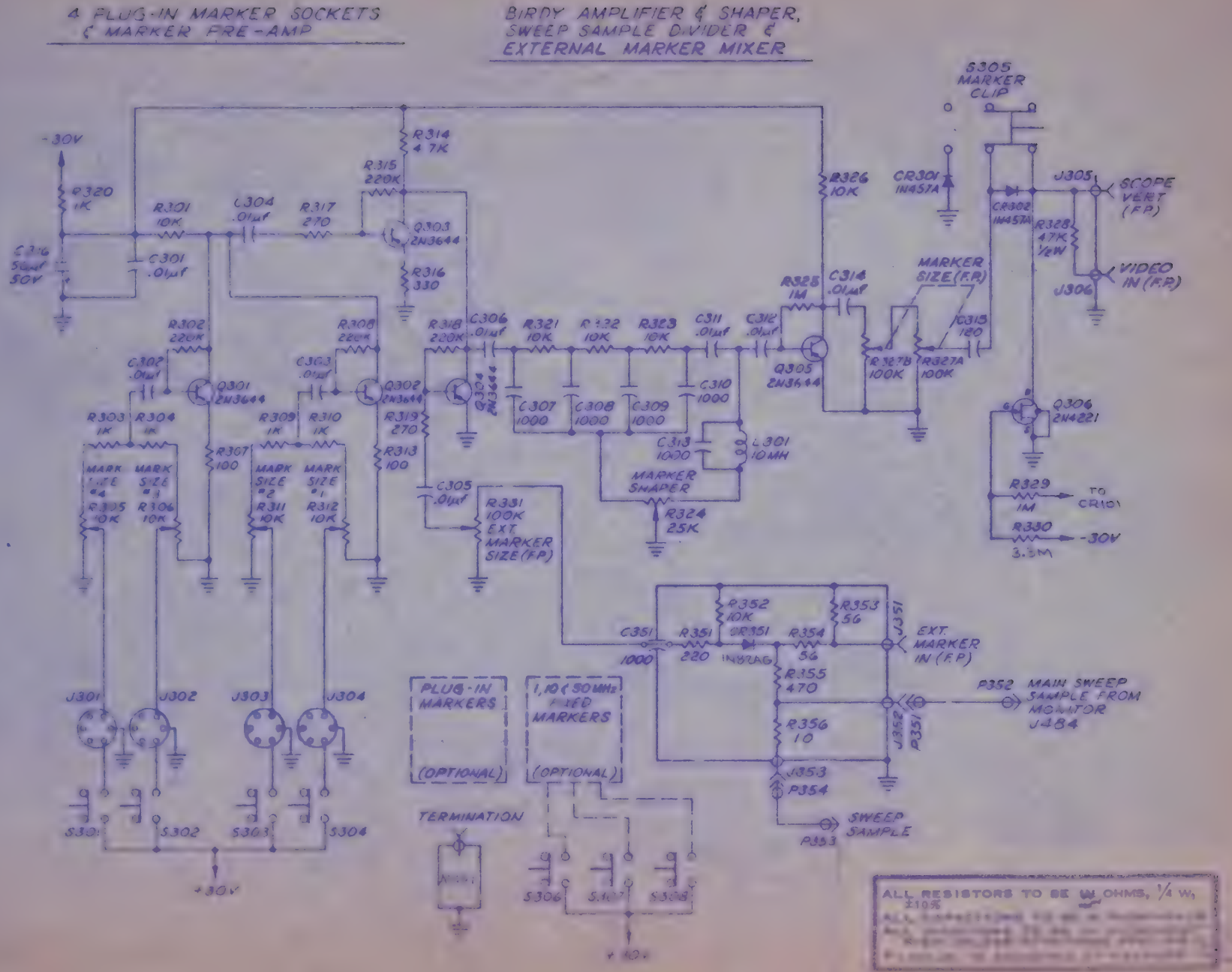
VR1	025-003	IN703
VR2	025-003	IN703
VR3	025-096	IN5086
VR5	025-018	IN708
VR6	025-096	IN5086

TERMINATIONS

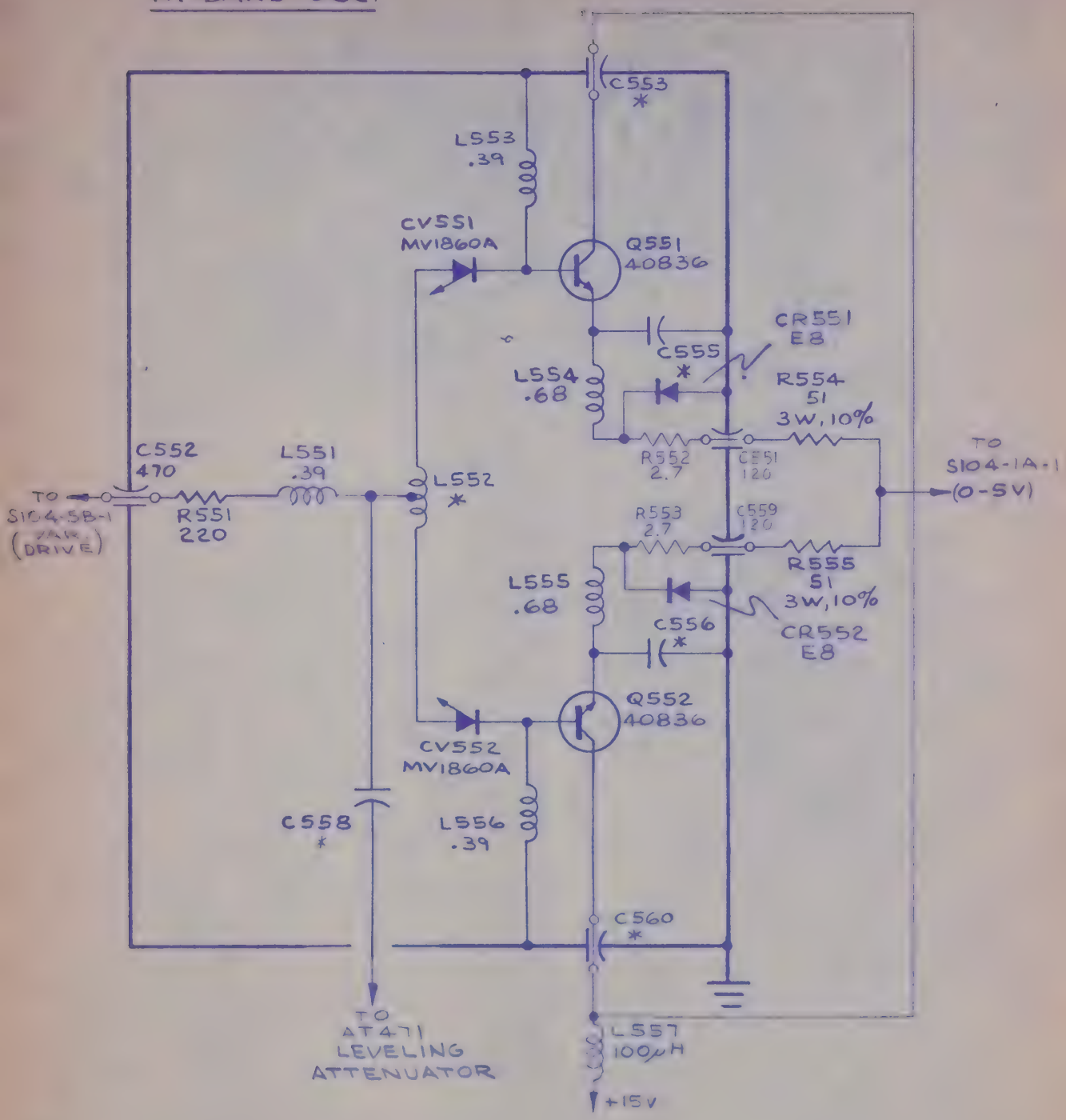
Z601	A200-005-01	Marker 50 ohm

TERMINATIONS - continued

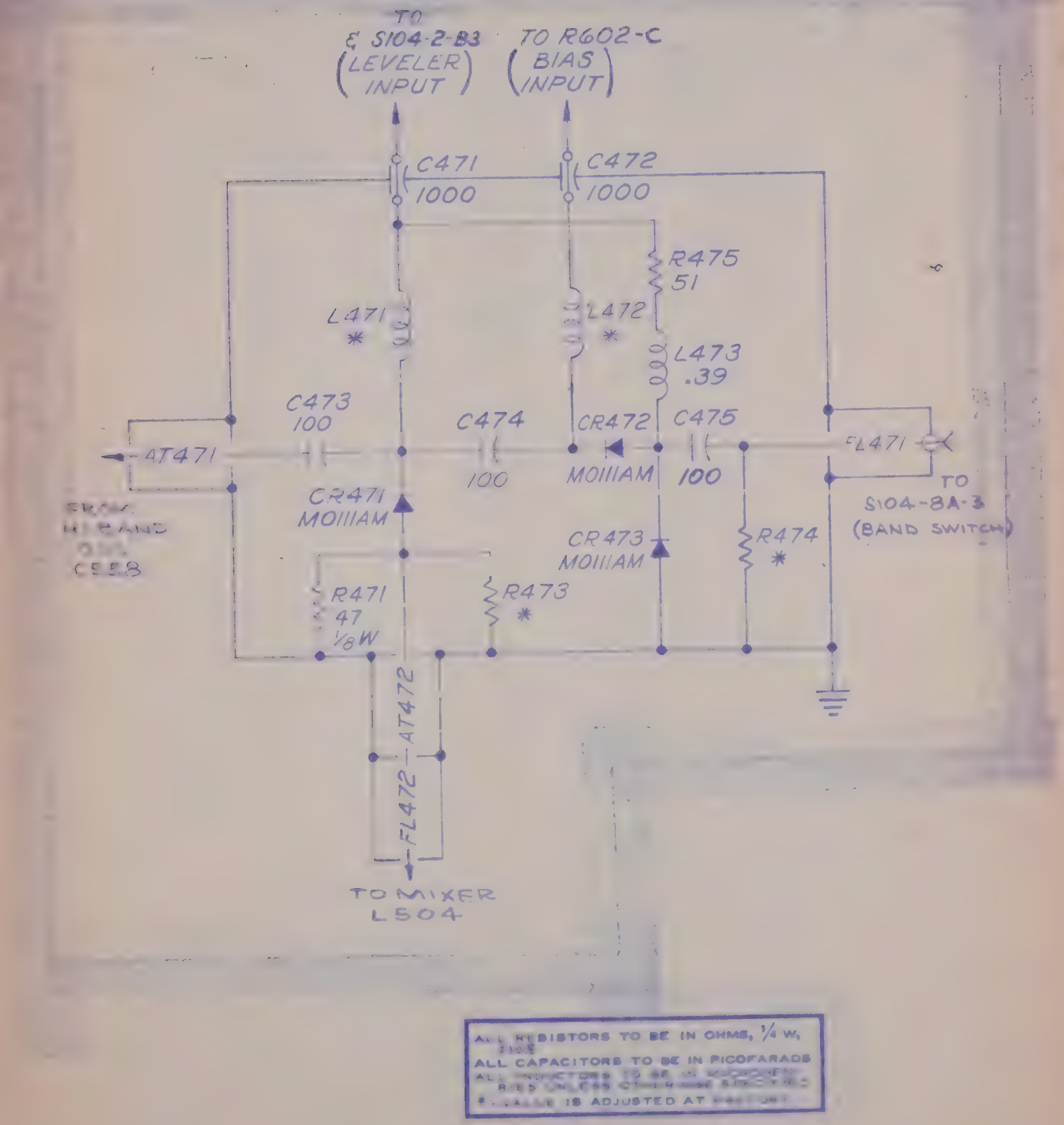
CIRCUIT REF. NO.	TEXSCAN STOCK NO.	DESCRIPTION
	A204-821	High Band Oscillator
	A204-524	High Band Attenuator
	A204-822	Middle Band Oscillator
	A204-768	Low Band Oscillator
	A204-826	Video Amplifier


4 PLUG-IN MARKER SOCKETS & MARKER PRE-AMP
BIRDY AMPLIFIER & SHAPER, SWEEP SAMPLE DIVIDER & EXTERNAL MARKER MIXER
-30V
R320 1K
C316 50µf 50V
R301 10K
C304 .01µf
R317 270
R314 4.7K
R315 220K
Q303 2N3644
R316 330
C301 .01µf
R326 10K
CR301 IN457A
S305 MARKER CLIP
J305
SCOPE VERT (F.P.)
CR302 IN457A
R328 4.7K ½W
J306
VIDEO IN (F.P.)
R325 1M
C314 .01µf
MARKER SIZE (F.P.)
C315 120
R327B 100K
R327A 100K
Q305 2N3644
Q306 2N4221
R329 1M
TO CR101
R330 3.3M
-30V
R302 220K
C302 .01µf
Q301 2N3644
R308 220K
C303 .01µf
Q302 2N3644
R318 220K
C306 .01µf
Q304 2N3644
R321 10K
R322 10K
R323 10K
C311 .01µf
C312 .01µf
C307 1000
C308 1000
C309 1000
C310 1000
C313 1000
L301 10MH
MARKER SHAPER
R324 25K
R303 1K
R304 1K
R309 1K
R310 1K
MARK SIZE "4"
MARK SIZE "3"
MARK SIZE "2"
MARK SIZE "1"
R305 10K
R306 10K
R311 10K
R312 10K
R307 100
R313 100
R319 270
C305 .01µf
R331 100K EXT MARKER SIZE (F.P.)
C351 1000
R351 220
CR351 IN276G
R352 10K
R353 56
R354 56
R355 470
R356 10
J351
EXT. MARKER IN (F.P.)
J352
P351
P352 MAIN SWEEP SAMPLE FROM MONITOR J484
J353
P354
P353 SWEEP SAMPLE
J301
J302
J303
J304
S301
S302
S303
S304
+30V
PLUG-IN MARKERS (OPTIONAL)
1, 10 (50 MHz) FIXED MARKERS (OPTIONAL)
TERMINATION
S306
S307
S308
+10V
ALL RESISTORS TO BE W OHMS, ¼ W, ±10%

HI BAND OSC.

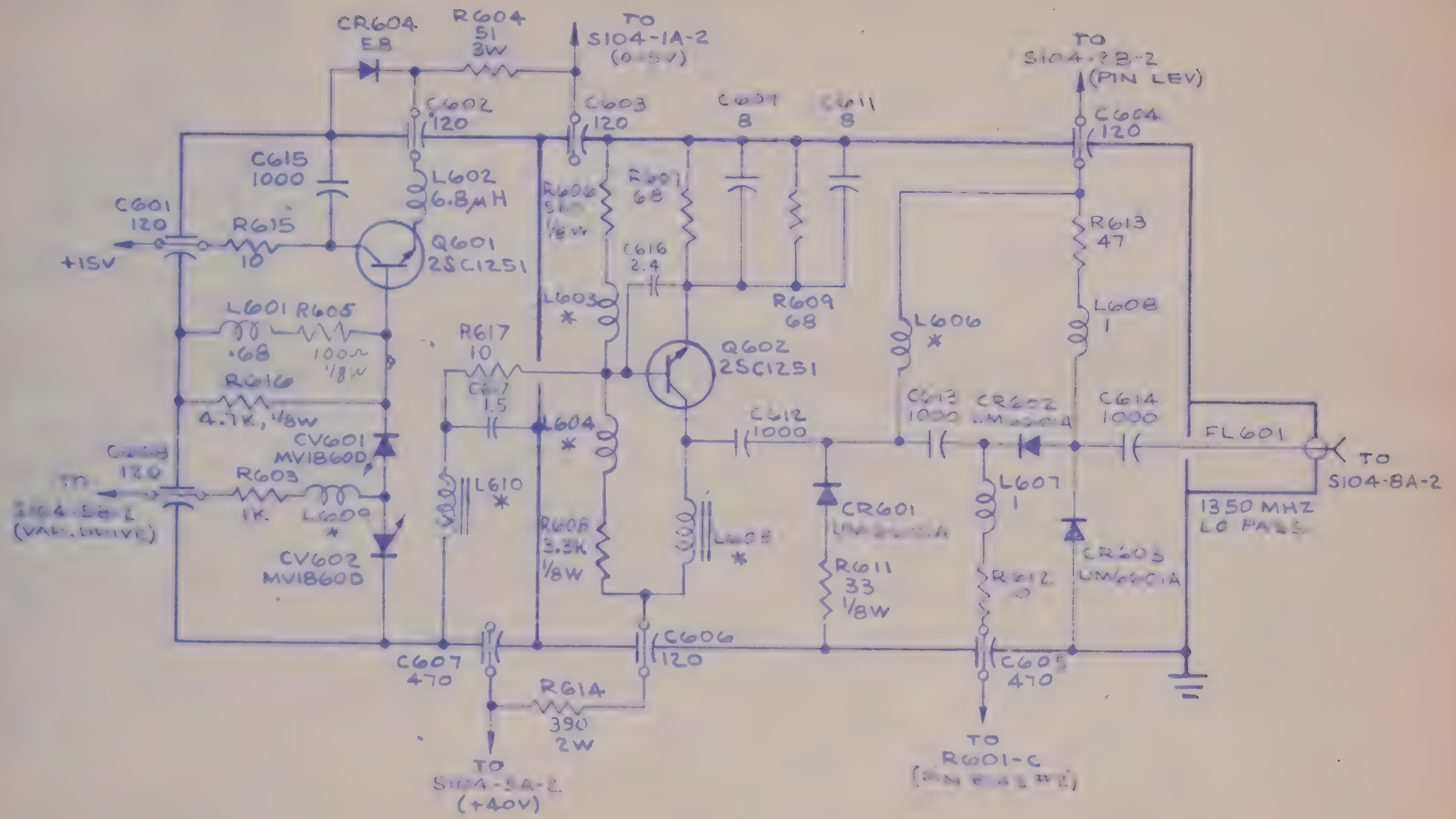


ALL RESISTORS TO BE IN OHMS, 1/4 W, ±10%
ALL CAPACITORS TO BE IN PICOFARADS
ALL INDUCTORS TO BE IN MICROHENRIES UNLESS OTHERWISE SPECIFIED
*-VALUE IS ADJUSTED AT FACTORY

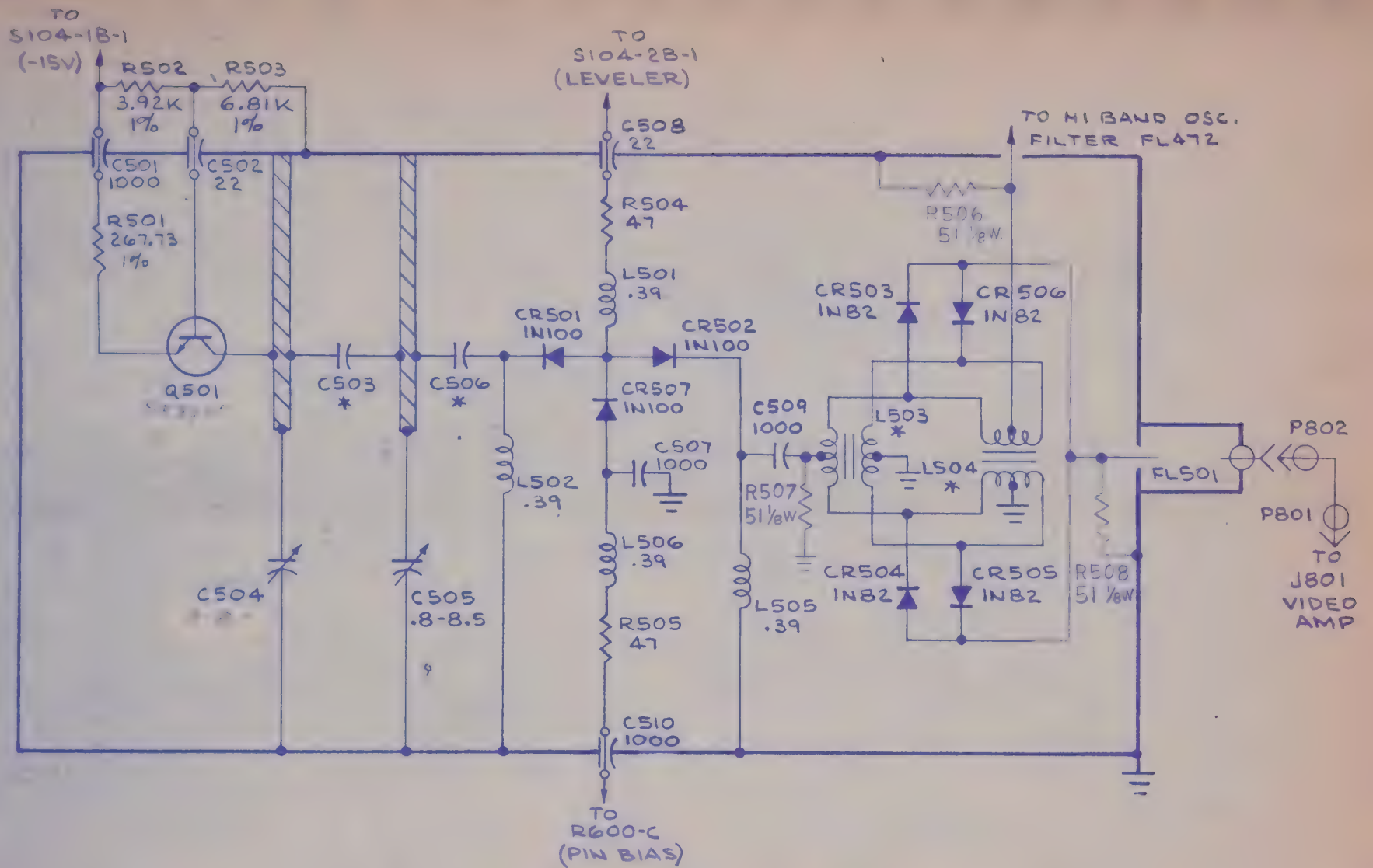


ALL RESISTORS TO BE IN OHMS, 1/4 W,
ALL CAPACITORS TO BE IN PICOFARADS
ALL INDUCTORS TO BE IN MICROHENRYS
UNLESS OTHERWISE INDICATED
* VALUE IS ADJUSTED AT FACTORY

MIDDLE BAND OSC.

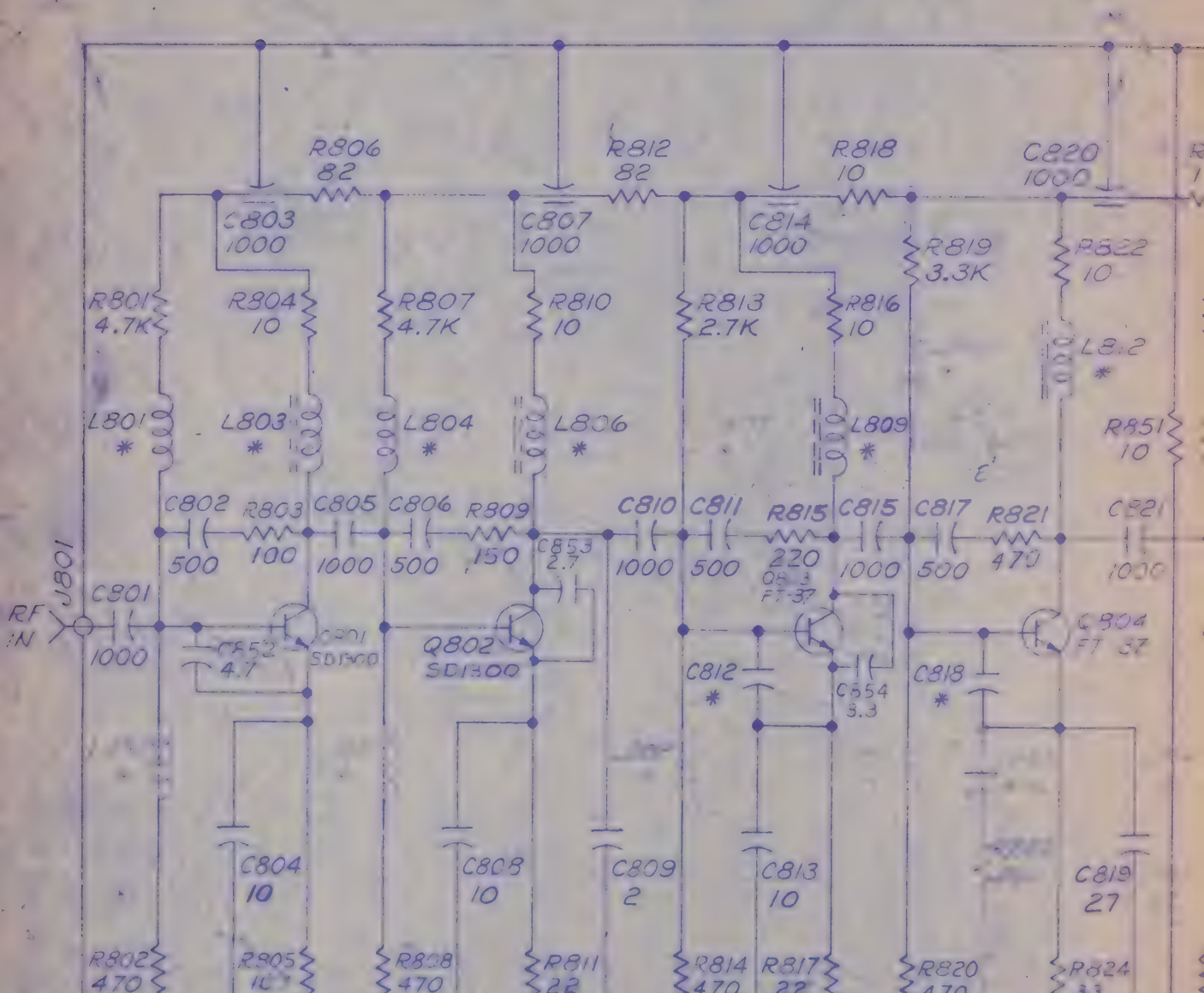


ALL RESISTORS TO BE IN OHMS, 1/4 W, ±10%
ALL CAPACITORS TO BE IN PICOFARADS
ALL INDUCTORS TO BE IN MICROHENRIES UNLESS OTHERWISE SPECIFIED
* - VALUE IS ADJUSTED AT FACTORY

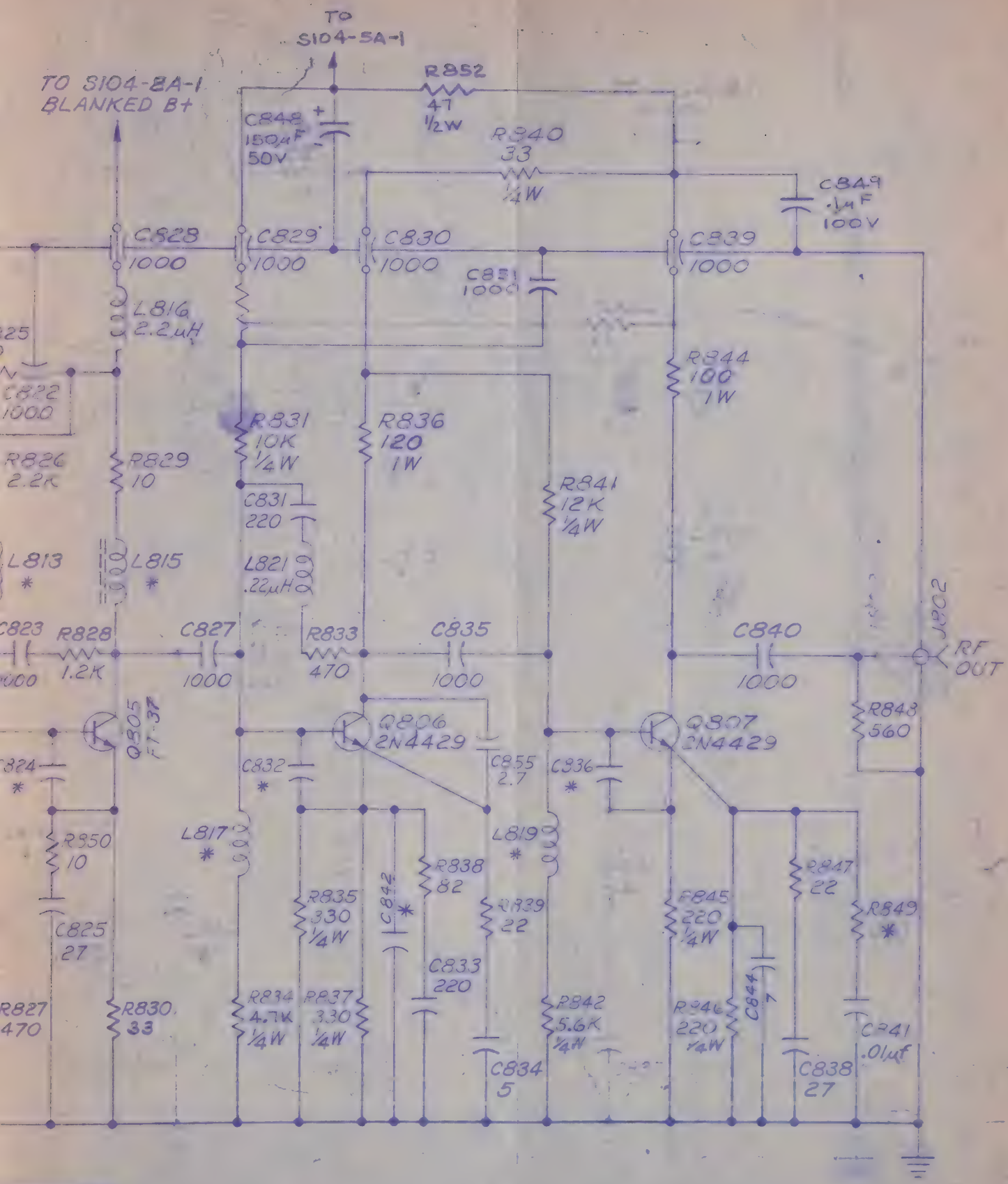


ALL RESISTORS TO BE IN OHMS, 1/4 W, ±10%
ALL CAPACITORS TO BE IN PICOFARADS
ALL INDUCTORS TO BE IN MICROHENRIES UNLESS OTHERWISE SPECIFIED
*-VALUE IS ADJUSTED AT FACTORY

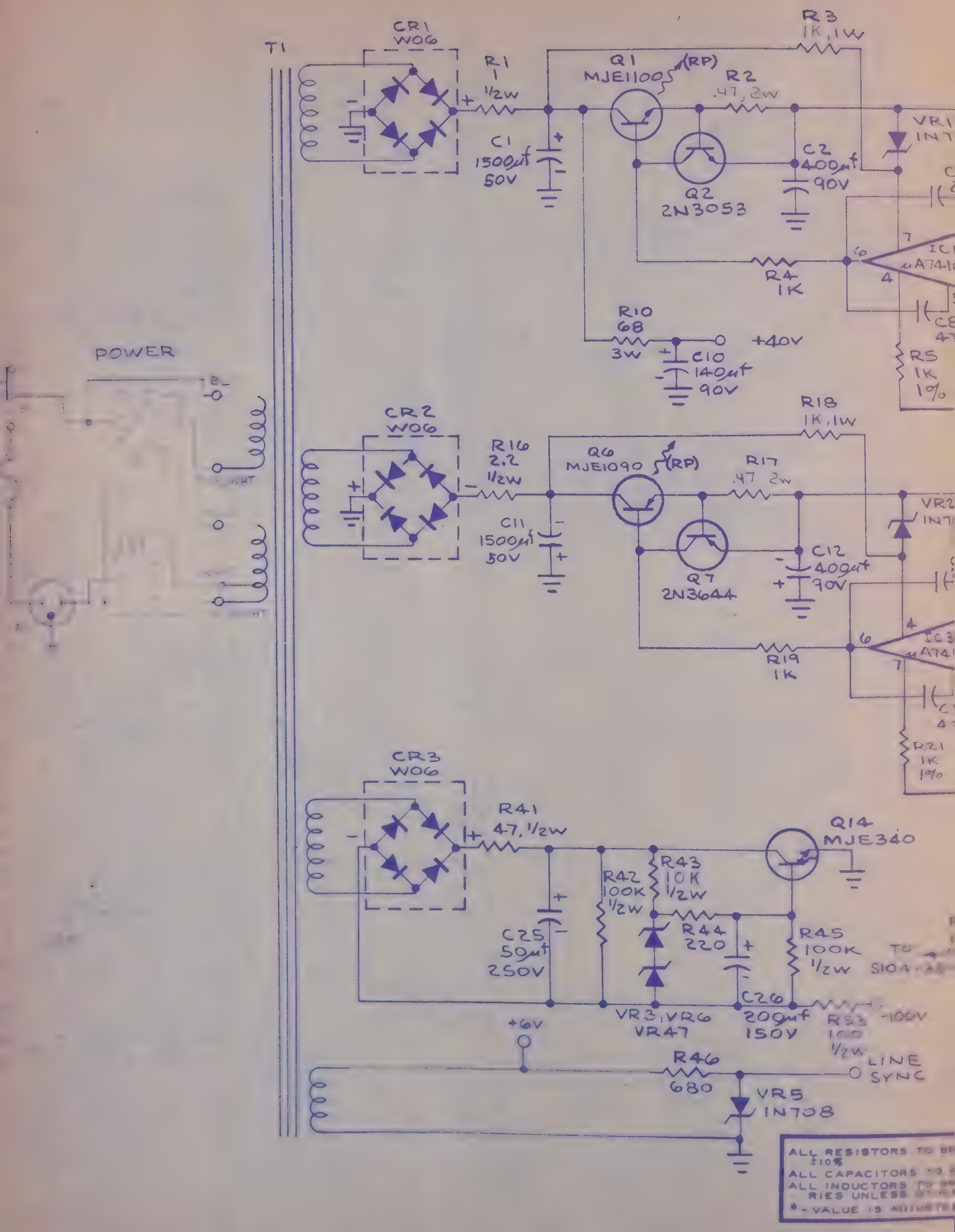
VIDEO AMPLIFIER



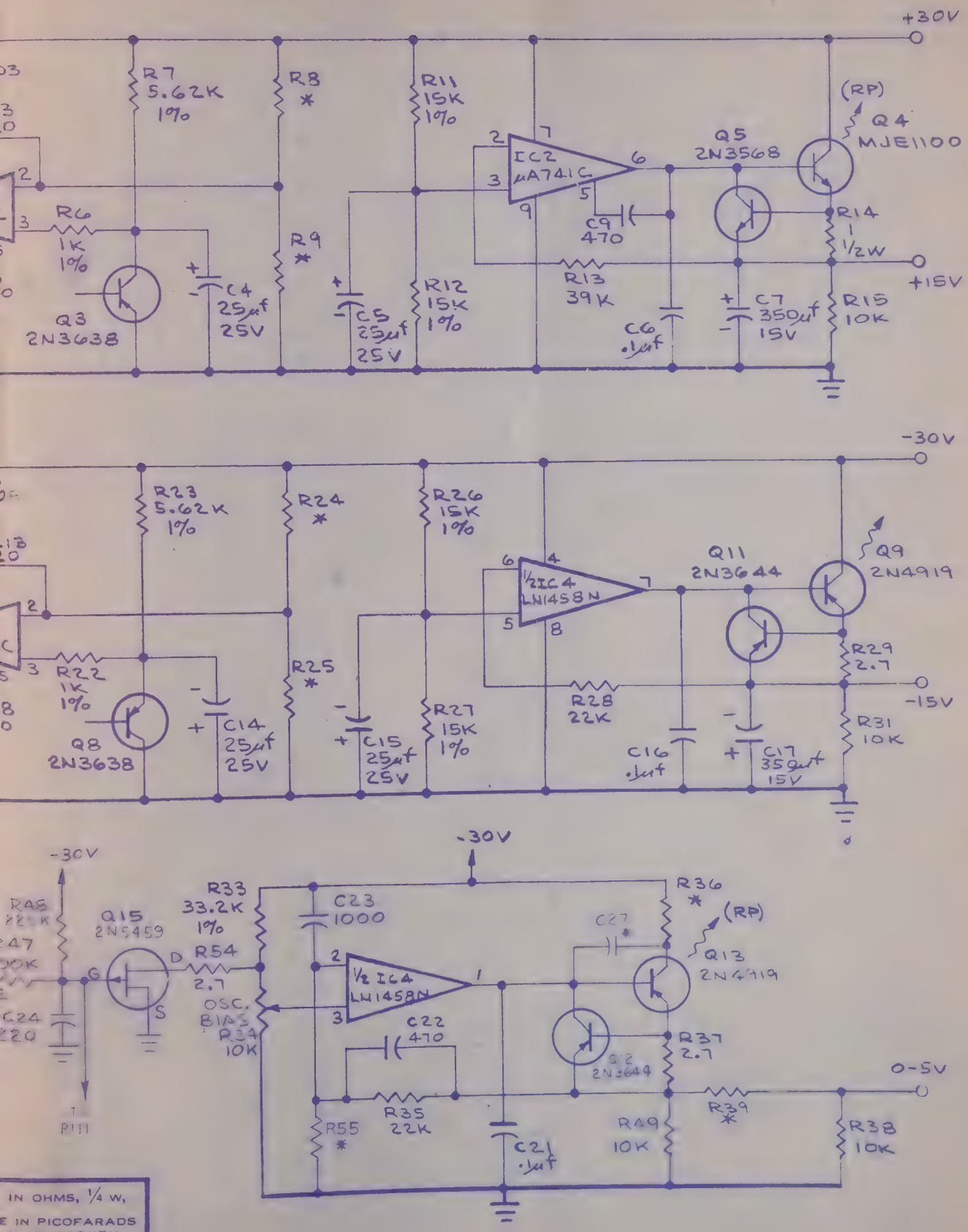
ALL RESISTORS TO BE ±10%
ALL CAPACITORS TO BE
ALL INDUCTANCES TO BE
RISES IN ITS OTHERWISE
* - VALUE IS

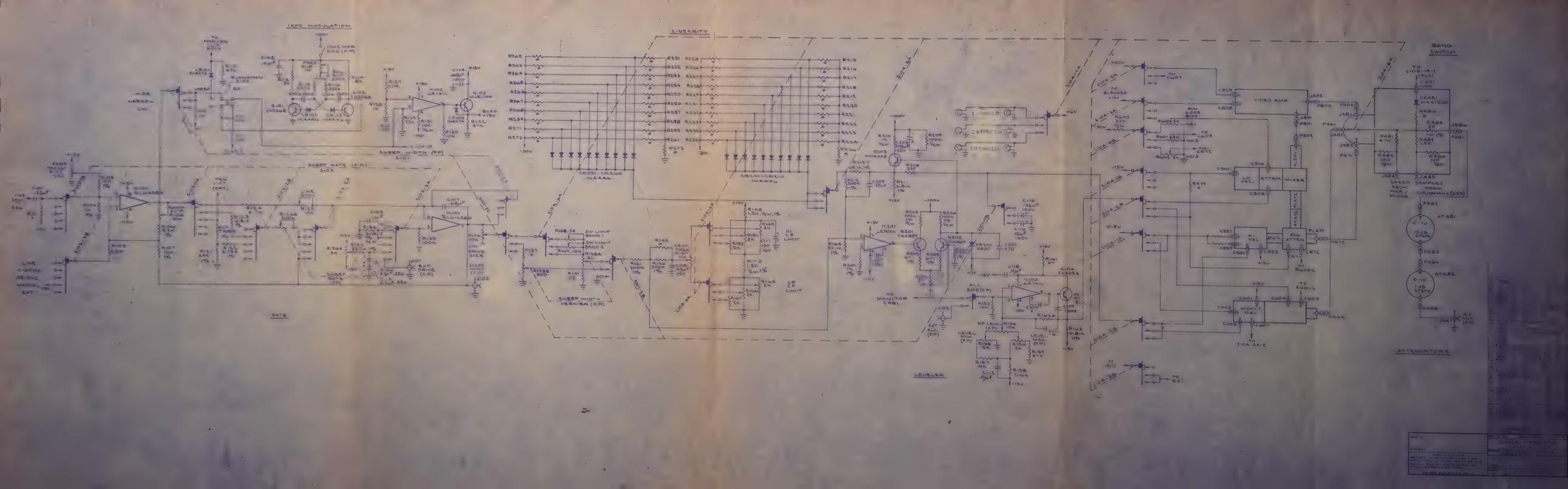


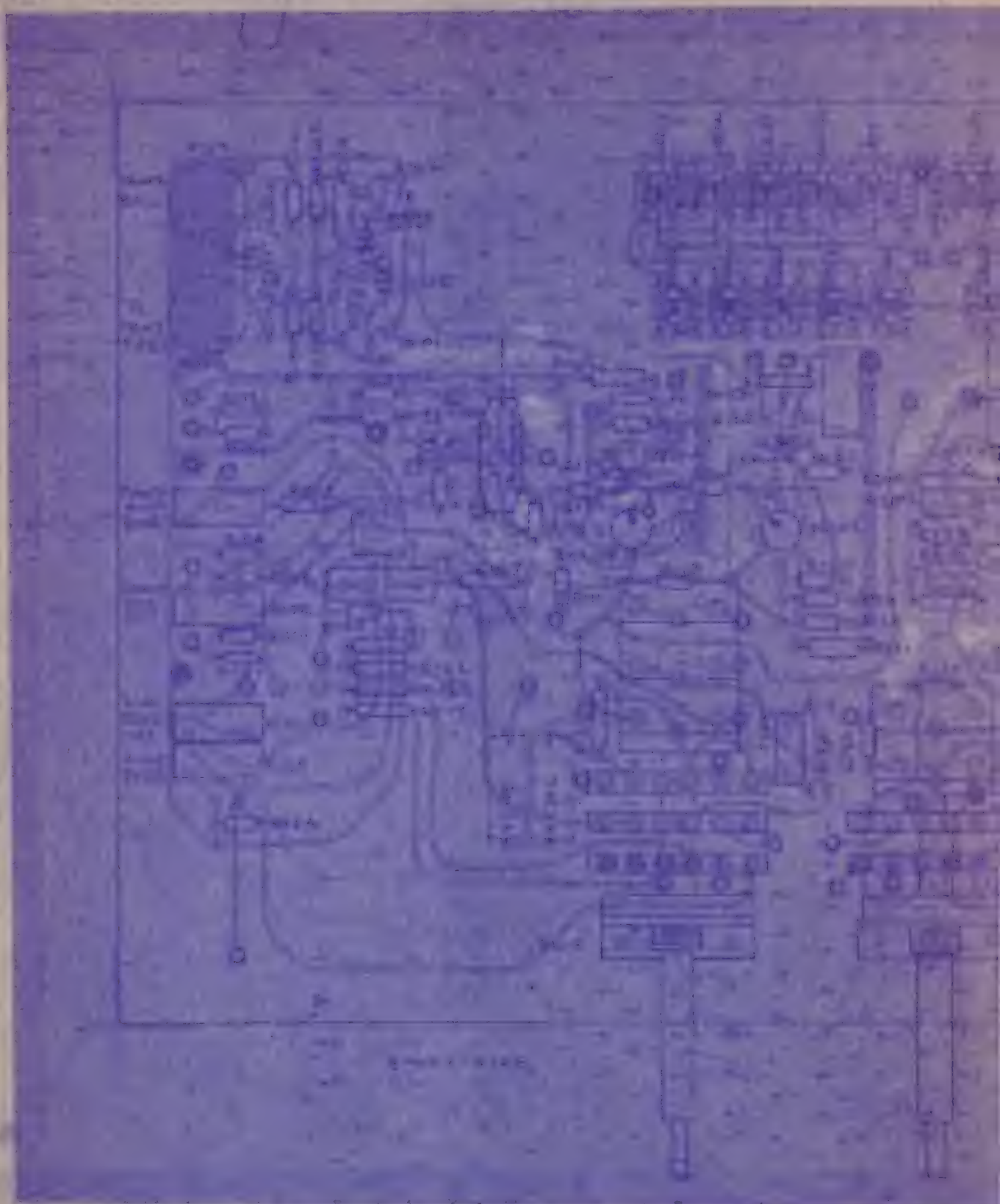
OHMS, 1/8 W,
PICOFARADS
MICROHEN-
E SPECIFIED
FACTORY

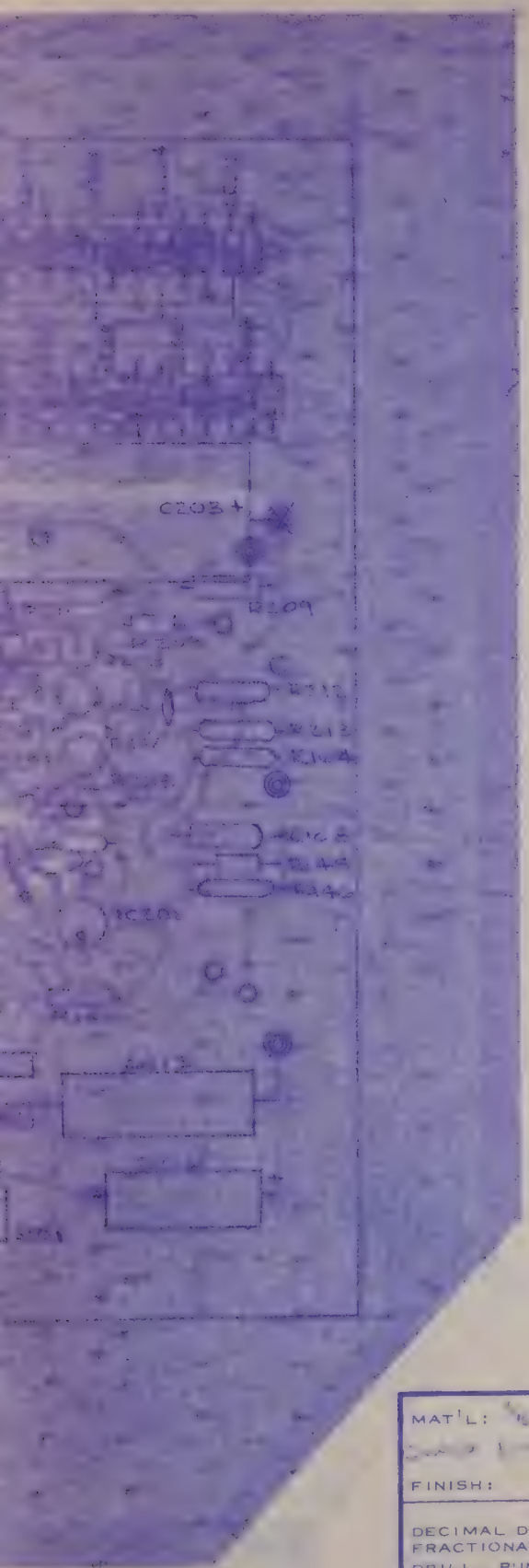

POWER
T1
CR1
W06
R1
1
1/2W
C1
1500µf
50V
Q1
MJE1100
(RP)
R2
.47, 2W
R3
1K, 1W
Q2
2N3053
C2
400µf
90V
VR1
IN7
R4
1K
R10
68
3W
C10
140µf
90V
+40V
R5
1K
1%
CR2
W06
R16
2.2
1/2W
C11
1500µf
50V
Q6
MJE1090
(RP)
R17
.47 2W
R18
1K, 1W
Q7
2N3644
C12
400µf
90V
VR2
IN7
R19
1K
R21
1K
1%
CR3
W06
R41
47, 1/2W
C25
50µf
250V
R42
100K
1/2W
R43
10K
1/2W
Q14
MJE340
R44
220
R45
100K
1/2W
TO
SIO4-A
C26
200µf
150V
VR3, VR6
VR47
-100V
+6V
R46
680
VR5
IN708
LINE
SYNC
ALL RESISTORS TO BE
±10%
ALL CAPACITORS
ALL INDUCTORS
RIES UNLESS
*-VALUE IS ADJUSTE

POWER SUPPLY




1KHZ MODULATION
LINEARITY
BAND SWITCH
ATTENUATORS
LEVELER
SWEEP WIDTH (FP) S101
SWEEP RATE (F.P.) S102
SWEEP WIDTH VERNIER (F.P.)
RATE
VIDEO AMP.
LO OSC.
ATTEN
MIXER
M1 OSC.
PIN ATTEN
MIDDLE OSC
SWEEP FROM MKR. MIXER
SAMPLES FROM 1/10 100 MHz (OPT)
TO S108-1A-1 (ALC)
TO MONITOR C481
ALC S105 (F.P.)
EXT ALC (F.P.)
LEVEL MAN (F.P.)
LEVEL VAR (F.P.)
EXT DRIVE (F.P.)
SCOPE HORIZ (F.P.)
LINE
TO MARKER S108
TO BLANKER +15V
TO C607
TO C605
TO C602
TO C604
TO C603
TO R601-L
TO S104-5A-2
TO R47
TO A12
TO R601-1K
TO R601-2K
TO R601-5K
PIN DIODE BIAS
BLANKING S102
RF
WIDE NARROW CW
MKR MIXER
SWEEP RATE
SWEEP WIDTH
LIN DRIVE SIZE
SCOPE HORIZ
EXT DRIVE
HI LEVEL LIMIT
LO LEVEL LIMIT
2W LIMIT BAND 1
2W LIMIT BAND 2
SWEEP WIDTH
SWEEP RATE
LEVEL VAR
LEVEL MAN
ALC
EXT ALC
MONITOR
BLKD.
1KHZ MOD. S108 (F.P.)
FREQ. ADJ.
BAL. ADJ.
MKR MIXER
CR251 - CR260 IN4446
CR261 - CR270 IN4446
R242 R243 R244 R245 R246 R247 R268 R269 R271 R272
R251 R252 R253 R254 R255 R256 R257 R258 R259 R261
R215 R216 R217 R218 R219 R220 R221 R222 R223 R224
R273
-30V
+30V
+15V
-15V
-100V
+40V
+5V
-5V
0-5V
0-10
0-70
10dB STEPS
1dB STEPS
AT481
AT482
P481
P482
P483
P484
P485
P486
J481
J482
J483
J484
J485
J486
J801
P801
P802
P803
P804
P805
P806
P807
P808
P809
P810
P811
P812
P813
P814
P815
P816
P817
P818
P819
P820
P821
P822
P823
P824
P825
P826
P827
P828
P829
P830
P831
P832
P833
P834
P835
P836
P837
P838
P839
P840





HOLE SCHEDULE		
HOLE	DESCRIPTION	QTY.

TERMINAL LEGEND:

○ - SMALL STD.

◎ - LG. HOLLOW

⊗ - TERM. ON TOP SIDE

◎ - LG. DBL. TURRET

REV	ECN.	DESCRIPTION	DATE
		SEE SHEET 1	
		SEE SHEET 1	
		SEE SHEET 1	
		SEE SHEET 1	

MAT'L:

FINISH:

SPECIFICATIONS
DECIMAL DIMENSIONS TO BE ± .005
FRACTIONAL DIMENSIONS TO BE ± 1/64
DRILL, PUNCH, AND COMMERCIAL STOCK SIZES DO NOT APPLY

DO NOT SCALE THIS PRINT

TEXSCAN CORPORATION
INDIANAPOLIS, INDIANA

SCALE | DRAWN BY | APP'D. BY

MAIN P.C.B.
VS-90B SUB-ASS'Y

SHEET 1 OF 1

B204-5A1

WARRANTY

Texscan Corporation warrants that each part of this product (except vacuum tubes and batteries) will be free from defects in material and workmanship under normal use and service. Texscan Corporation's obligation under this warranty shall be limited to repairing or replacing, F.O.B. Indianapolis, Indiana, each part of the product (except vacuum tubes and batteries) which is defective, provided that buyer gives Texscan written notice of such defect within a period of one year commencing with the delivery of the product by Texscan Corporation. The remedy set forth herein shall be the only remedy available to the buyer for breach of this warranty, and in no event shall Texscan Corporation be liable for incidental or consequential damages for such breach. This warranty shall not apply to any part of the product which, without fault of Texscan Corporation, has been subject to alteration, failure caused by a part not supplied by Texscan Corporation, accident, fire or other casualty, negligence or misuse, or to any part rather than as a result of defect.

Except for warranties set forth above, and the warranties, if any, available to the buyer from the persons who supply Texscan Corporation any vacuum tubes or batteries contained in the product, there are no warranties, express or implied (including, without implied limitation, any implied warranties of merchantability or fitness), with respect to the condition of the product or their suitability for the use intended for them by the buyer or by a purchaser from the buyer.

REV. 9/2/76

MP MASTER
MA33168